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IL-3020-D1175

APPENDIX D

QUALITY ASSURANCE PROJECT PLAN (QAPP)

SAUGET/DEAD CREEK PROJECT SAUGET, ILLINOIS

OCTOBER 1986

Prepared for:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Approved by:

Andrea P. Schuessler — Date: 10/27/86
E & E Quality Assurance Officer

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APPENDIX D

QUALITY ASSURANCE PROJECT PLAN (QAPP)

DEAD CREEK PROJECT
SAUGET, ILLINOIS

MAY 1986

Prepared for:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Approved by:

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IEPA ~~Region V~~ Quality Assurance Officer

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Official copies and subsequent revisions will be delivered to:

Quality Assurance Officers

IEPA Region V	Karl Reed
E & E	A.P. Schuessler

Project Managers

IEPA Region V	J. Larson
E & E	M. Miller

LIST OF ILLUSTRATIONS

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1. INTRODUCTION

This Quality Assurance Project Plan (QAPP) presents the policies, organization, objectives, functional activities, and specific Quality Assurance (QA) and Quality Control (QC) activities for the Dead Creek project in Sauget, Illinois. The purpose of the program is to ensure that all technical data generated are accurate, representative, and will ultimately withstand judicial scrutiny.

QC consists of a system of checks on field sampling and laboratory analysis (through the use of field blanks, duplicates, documentation of all sample movement, chain of custody records, etc.) to provide supporting information on the quality of the methods employed and the analytical data.

QA consists of overview checking to certify that the QC procedures have been properly implemented to produce accurate data. QA is a supervisory function.

All QA/QC procedures will be in accordance with applicable professional technical standards, United States Environmental Protection Agency (USEPA) requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP is prepared in accordance with all ~~Region V~~ Illinois EPA (IEPA) and USEPA QAPP guidance documents.

The QAPP incorporates the following activities:

- Sample collection, control, chain-of-custody, and analysis;
- Document control;
- Laboratory instrumentation, analysis, and control; and
- Review of project deliverables.

Analytical samples will be collected in the field utilizing standard operating procedures (SOPs) and sent to Ecology and Environment, Inc.'s (E & E's) Analytical Services Center (ASC) for analysis. Duplicates, replicates, and spiked samples will be used to develop estimates of the quality of the analytical data. Field audits will be conducted to verify that proper sampling techniques and chain-of-custody procedures are followed. Field data compilation, tabulation, and analysis will be checked for accuracy. Calculations and other post-field tasks will be reviewed by project personnel.

Equipment used to take field measurements will be maintained and calibrated in accordance with established procedures (see Section 7). Records of calibration and maintenance will be kept by assigned personnel. Field testing and data acquisition will be performed in accordance with standard protocols.

Document control procedures will be used to coordinate the distribution, coding, storage, retrieval, and review of all data collected during the Dead Creek Project. These procedures will ensure safeguarding of any sensitive materials generated or obtained during the study.

2. PROJECT DESCRIPTION

This QAPP was prepared pursuant to the contract issued by the Illinois Environmental Protection Agency (IEPA) to Ecology and Environment, Inc., (E & E) to conduct a Remedial Investigation/ Feasibility Study (RI/FS) in the Dead Creek area in the towns of Sauget and Cahokia in St. Clair County, Illinois. The project area specifically includes various sites in the two towns that were used for industrial waste dumping or as landfills, as well as portions of Dead Creek--a stream that traverses through the project area before flowing into the Mississippi River. The project will be conducted in cooperation with the IEPA Division of Land Pollution Control.

The objective of the sampling and analysis of the Dead Creek Project Area is to define the nature and extent of contamination by investigating air quality, surface and subsurface soils, and groundwater, as well as surface water and sediments in Dead Creek. Sampling will be conducted in 18 areas: six sectors of Dead Creek, designated A through F, and 12 sites, designated G through R. The analytical data resulting from the RI will be used to prepare a Feasibility Study (FS) to determine if remedial actions are necessary and what level and types of actions are required to mitigate the contamination. The field work for the RI is expected to begin in the middle of March 1986 and be completed by the end of May 1986 (approximately 12 weeks).

Samples to be collected from the Dead Creek Project sites include:

- Surface soil samples;

- Subsurface soil samples (from borings);
- Groundwater samples; and
- Surface water/sediment samples.

In addition, air quality investigations will be conducted on a routine basis during on-site work. Soil gas measurements will be taken as necessary, but will not exceed 96 specific locations.

Table 2-1 provides a summary of the number of samples to be collected for each of the various sample media, at the various sites. The site locations are shown on Figure 2-1.

Table 2-1

DEAD CREEK PROJECT SAMPLING FOR VARIOUS MEDIA

Sample Medium	Site	Sample Matrix	Number of Samples	Comments
Surface water/sediment	A	Water	3	Grab and composite
" "	B	"	3	" "
" "	C	Water/sediment	2/2	" "
" "	D	" "	1/2	" "
" "	E	" "	3/10	" "
" "	F	" "	4/10	" "
" "	M	" "	2/3	" "
" "	Field QC samples*	" "	5/6	" "
Surface soil	G	Soil	40	Grid (50 foot)
" "	H	"	5	Random
" "	I	"	32	Grid (100 foot)
" "	J	"	5	Random
" "	N	"	3	"
" "	Field QC samples*	"	15	Random
" "	To be determined	"	10	Dioxin
Subsurface soil	G	Soil	10	Composite
" "	H	"	5	"
" "	I	"	15	"
" "	J	"	5	"
" "	K	"	3	"
" "	L	"	4	"
" "	N	"	2	"
" "	Field QC samples*	"	12	"
Groundwater	Existing monitoring wells	Water	12**	Assigned wells
"	Existing residential wells	"	5	" "
"	New monitoring wells	"	20	" "
"	Field QC samples for wells*	"	8	
Total Samples			199 soil/sediment 68 water 96 soil gas***	

*Field QC samples include one duplicate per 10 samples and one blank per day or per shipment if more than one shipment is made per day.

**Actual number of samples to be determined. Only 8 of 12 existing wells have been located. All wells need to be reconstructed prior to sampling.

***See Section 2.6 Soil Gas Survey for specific locations.

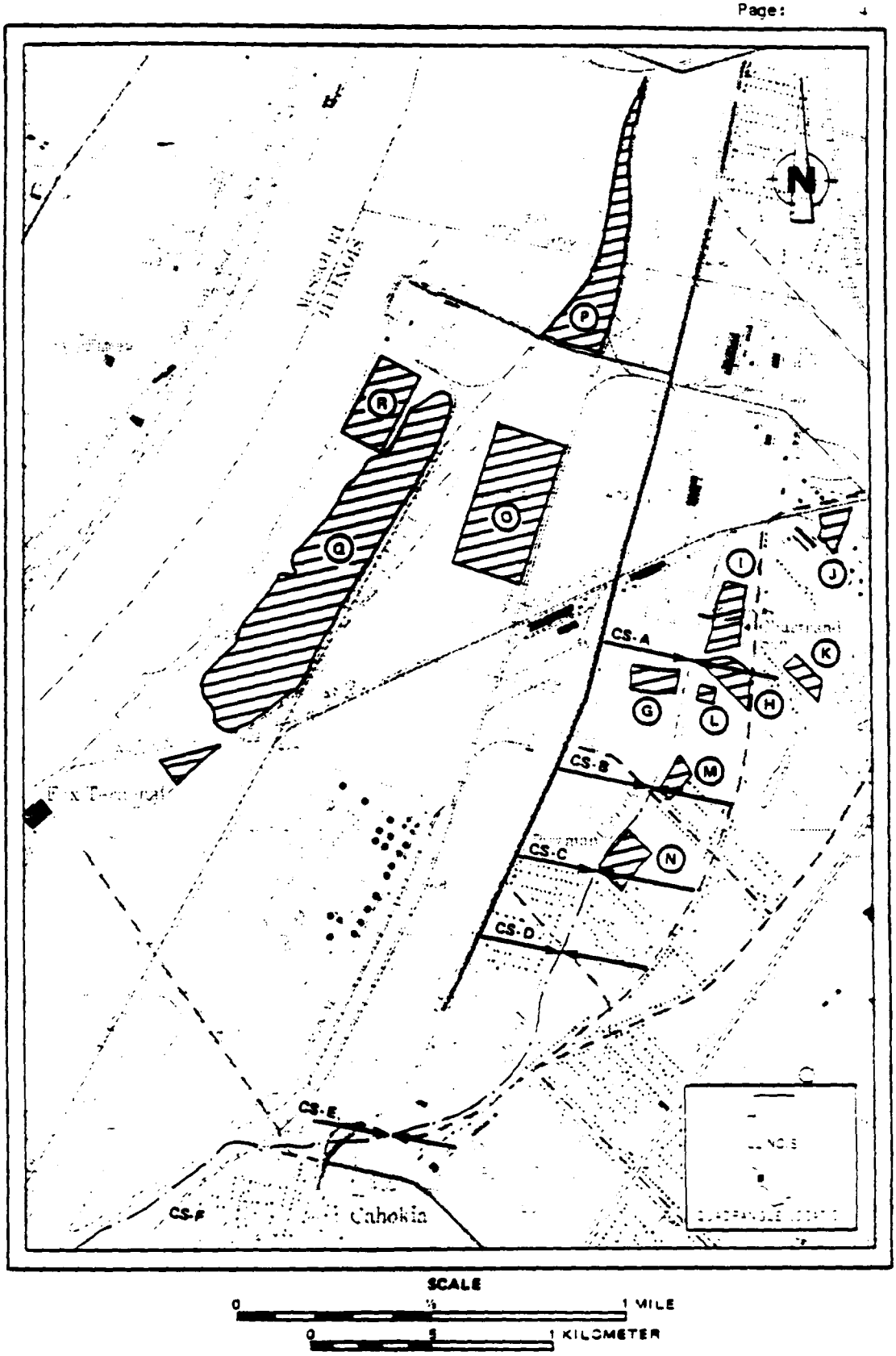

Figure 2–1 DEAD CREEK PROJECT AREA SITE LOCATION MAP

3. PROJECT ORGANIZATION AND RESPONSIBILITY

This QAPP provides for designated QA personnel to review products and provide guidance on QA/QC matters, and outlines the approach to be followed to assure that products of sufficient quality are obtained. In accordance with E & E's corporate QA program, experienced senior technical staff members will be assigned to project QA/QC functions. Figure 3-1 presents the program organization. Figure 3-2 presents the ASC management organization. The management structure provides for direct and constant operational responsibility, clear lines of authority, and the integration of QA activities. The various QA functions are explained below.

IEPA QA/QC Responsibilities

IEPA is responsible for all performance and system audits which include laboratory and field audits, review of QA/QC data validation procedures, as well as intermittent and final review and evaluation of analytical results, including supporting QC data. IEPA conducted initital performance and system audits during July and August 1985.

Project Management

The project management staff consists of IEPA Project Officer J. Larson and E & E project personnel G. Strobel, Project Director; M. Miller, Project Manager; and M. McCarrin, Assistant Project Manager. They are responsible for implementing the project and will have the authority to commit the resources necessary to meet project objectives and requirements. Primary functions are to insure that

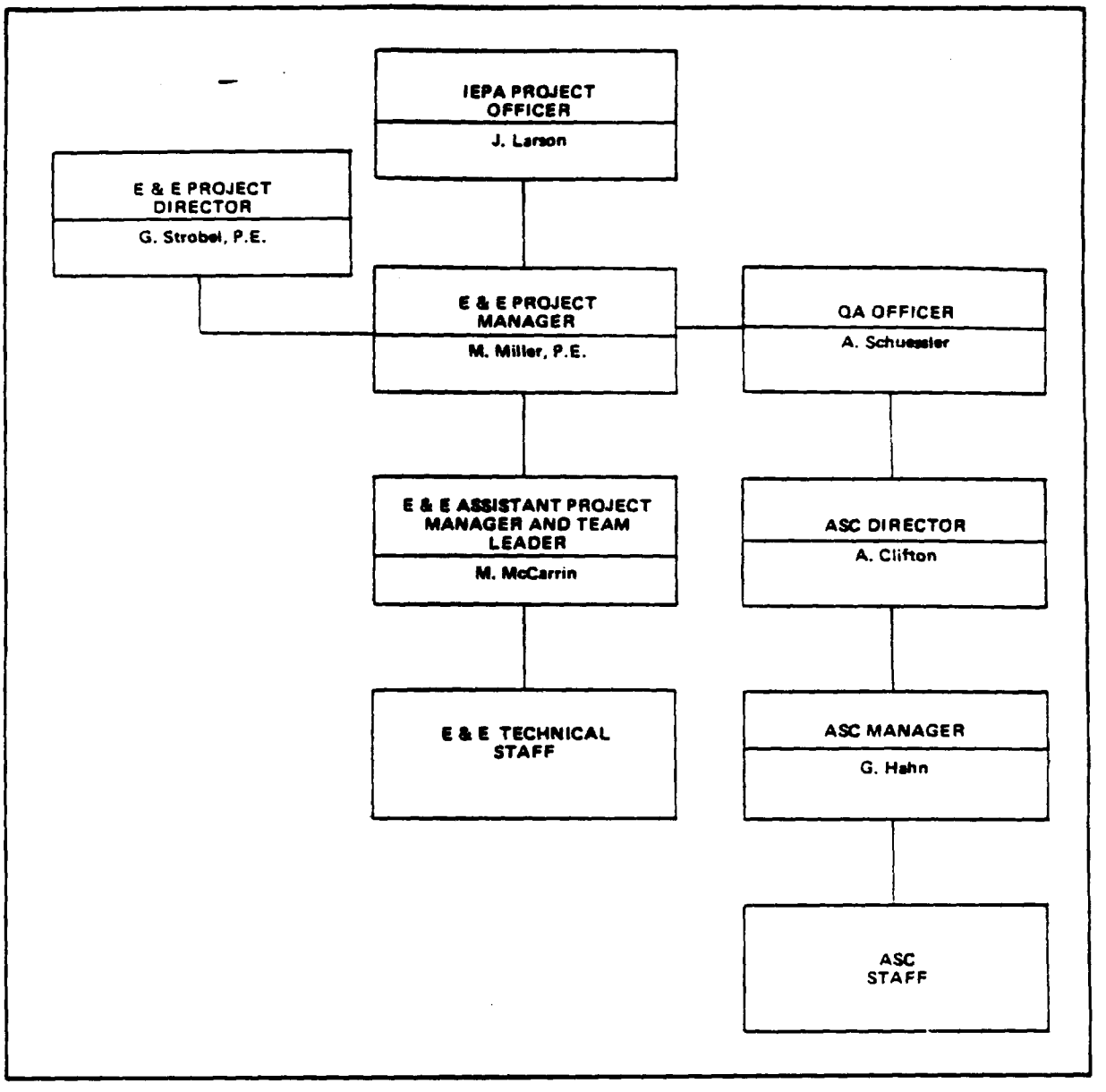

Figure 3–1 QUALITY ASSURANCE PROGRAM ORGANIZATION

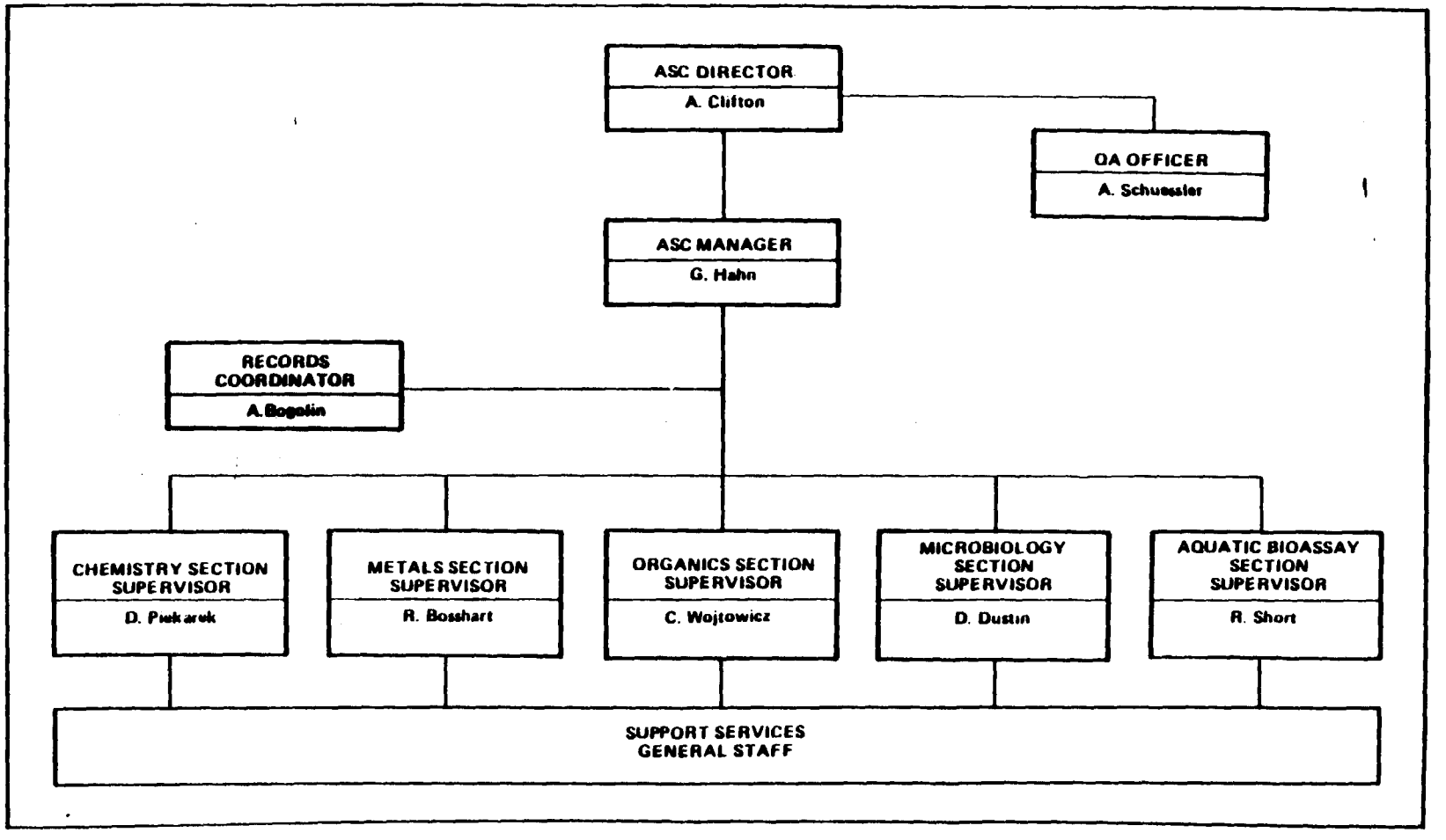

Figure 3–2 ANALYTICAL SERVICES CENTER MANAGEMENT ORGANIZATION

technical, financial, and scheduling objectives are achieved successfully. With full responsibility and authority for project performance, they will:

- Define project objectives and develop a detailed work plan and schedule;
- Establish project policy and procedures to address the specific needs of the Dead Creek project as a whole, as well as the objectives of each task;
- Acquire and apply technical, corporate, and/or subcontractor resources as needed to insure performance within budget and schedule constraints;
- Orient all team leaders and support staff concerning the project's special considerations;
- Monitor and direct the team leaders;
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
- Review the work performed on each task to insure its quality, responsiveness, and timeliness;
- Review and analyze overall task performance with respect to planned requirements and authorizations;
- Approve all external Dead Creek project reports (deliverables) before their distribution;
- Ultimately be responsible for the preparation and quality of interim and final Dead Creek project reports: and
- Represent the project team at meetings and public hearings.

Team Leader for Dead Creek Project

The project managers will be supported by a field team leader who will be responsible for leading and coordinating the day-to-day activities of the various resource specialists under his supervision. The team leader is a highly experienced environmental professional who will report directly to the project manager. The Team Leader and Assistant Project Manager assigned to the project is M. McCarrin. Specific team leader responsibilities include:

- Provision of day-to-day coordination with the project manager on technical issues in specific areas of expertise;
- Development and implementation of team-related work plans, assurance of schedule compliance, and adherence to management-developed study requirements;
- Coordination and management of team staff;
- Assure compliance with applicable TSCA and DOT regulations for samples requiring dioxin analysis;
- Implementation of QC for technical data provided by the team staff;
- Adherence to work schedules provided by the project manager;
- Authorship, review, and approval of text and graphics required for team efforts;
- Coordination of technical efforts of subcontractors assisting the team;
- Identification of problems at the team level, discussion of resolutions with the project manager, and provision of communication between team and upper management; and
- Participation in the preparation of the final report.

Technical Staff

The technical staff (team members) for this project will be drawn from E & E's pool of corporate resources and from the organizations of the various subcontractors associated with the project. The technical team staff will be utilized to gather data, analyze data, and prepare various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

QA Project Officer

The QA project officer will be A. Schuessler. She is responsible for maintaining quality assurance for the Dead Creek Project. Specific functions and duties include:

- Coordinating client meetings to determine retention time of QA records, storage requirements and facilities, identification of QA records, and time of transfer of QA records to client facilities;

- Providing guidelines and information as required to assist the QA project managers in the planning, development, and implementation of the QA program for their specific projects;

- Assuring that records of investigatory tasks conform to applicable requirements prior to delivery to clients and assuring that necessary corrective actions have been taken;

- Assuring use of the latest approved procedures, checklists, and forms required to implement check or approval functions as may be specified by the appropriate regulatory agency or client; and

- Establishing a project review group to investigate potential nonconformance and corrective actions and recommend measures to prevent recurrence of any nonconformance.

Analytical Services Center (ASC) Director

The ASC director is A. Clifton. He is responsible for all analytical work and works in conjunction with the QA unit. He maintains liaison with the QA officer regarding QA and custody requirements. Specific duties include:

- Maintaining indexed master copies of all laboratory project records and final reports, listing for each project the equipment, instrument methods, nature of project, date project was initiated, current status, name of sponsor, name of project manager, and status of final report;

- Maintaining copies of the methods and safety manual;

- Conducting inspections of projects and keeping written records of the inspections. For projects lasting less than six months, the QA unit conducts at least one inspection. For projects lasting more than six months, inspections are conducted at least every three months;

- Submitting to the project director and the project managers written status reports on the project, noting any problems, recommendations, and corrective actions taken;

- Reviewing all final reports for accuracy; and

- Signing a statement specifying the dates on which QA inspections were made and findings were reported to management and to the project managers.

ASC Manager

The ASC Manager is G. Hahn. He maintains liaison with the ASC director regarding QA elements of specific sample analyses tasks. He reports to the ASC director and works in conjunction with the QA unit. Specific duties include:

- Developing project specific protocols with the laboratory director;

- Insuring that personnel clearly understand their required tasks;

- Insuring that the project is carried out in accordance with the protocol;

- Insuring that all project QA/QC methods are followed;

- Insuring that all data generated during a project are accurately recorded and verified;

- Insuring that any problems reported during the monitoring of a project by the QA unit are reported to the QA director and that corrective actions are taken and documented; and

- Insuring that project protocol, as well as the final report and all the supporting raw data, are transferred to suitable archives upon completion of the project.

ASC Staff

Each member of the ASC staff performs an assigned QA function that is pertinent to and within the scope of his or her knowledge, experience, training, and aptitude. An individual is assigned the responsibility for checking, reviewing, or otherwise verifying that a sample analysis activity has been correctly performed. The following is a breakdown of analytical areas and their assigned personnel.

- GC/MS: Caryn Wojtowicz - Supervisor; Mike Scanlon, Cindy Stempniak, and Lynn Sullivan - Analysts.

- GC: Caryn Wojtowicz - Supervisor; and David Willy - Analyst.

- Metals: Bob Bosshart - Supervisor; Jim Olka and Richard Nagler - Analysts.

- General/Wet: Dietmar Piekarek - Supervisor; and Paul Azzopardi - Technician.

ASC Facilities

E & E maintains a certified chemical and biological laboratory (the ASC) staffed by full-time scientists and technicians and equipped with state-of-the-art instrumentation for the full range of water, waste, air, sediment, and soil quality parameters.

All laboratory work is performed in accordance with guidelines established by USEPA, the Water Pollution Control Federation, and/or the American Society for Testing and Materials (ASTM). When approved protocols do not exist, the ASC staff develops and validates appropriate analytical methods. In addition, QA and QC programs are maintained for the instruments and the analytical procedures used.

E & E's laboratory is certified by the New York State Department of Health for the analysis of drinking water and wastewater, and is approved by the New York State Department of Environmental Conservation for the analysis of samples associated with state-sponsored Superfund activities. In addition, the ASC is contracted to USEPA for the analysis of organic samples under the Contract Laboratory Program (CLP).

Equipment. The ASC is equipped with the most advanced instrumentation for fast, accurate analyses of air, water, and sediment samples. Major instruments include:

- Gas Chromatograph/Mass Spectrometer/Data System (GC/MS/DS), Hewlett Packard Model 5993B, equipped with a disk-based data system and high-speed computer, capillary interface, and jet separator.

- Gas Chromatograph/Mass Spectrometer/Data System (GC/MS/DS), Hewlett Packard Model 5995C, equipped with RTE-6 data system and dual (packed/capillary) column capability.

- Hewlett Packard 59708 Mass Spectral Detector for capillary column operation interfaced to a HP5890 gas chromatograph.

- Hewlett Packard Model 7675A Automated Purge and Trap Sampler.

- Varian Model 3700 Gas Chromatograph (GC) with flame ionization, Hall, and electron capture detectors.

- Varian Vista 6000 GC with electron capture and flame photometric detectors and capillary capability.

- Hewlett Packard 5890 scanning gas chromatograph equipped with electron capture and flame ionization detector.

- Tekmar LSC-2 Liquid Sample Concentrator for volatile organic analysis.

- Varian 4270 Computing Integrator.

- Spectra-Physics Model SP 4100 and SP 4270 Computing Integrators.

- Instrumentation Laboratory Model 457 Fully Automated Atomic Absorption Spectrophotometer including a Model 655 Furnace Atomizer.

- Perkin Elmer 5000 Zeeman Fully Automated Atomic Absorption Spectrophotometer (AAS) with Furnace Atomizer, Zeeman background correction system, and auto sampler.

- Perkin Elmer PE II Inductively Coupled Argon Plasma (ICAP) Spectrometer.

Analytical Capabilities. The ASC is fully equipped for analysis of all types of water, air, and soil samples for chemical contaminants, bacteriological quality, and general characterization. Proven and approved analytical techniques are used, backed up by a rigorous system of QC and QA checks to ensure reliable and defensible data.

Organic analysis is accomplished by GC and/or GC/MS. Liquid, soil, and air samples are analyzed routinely for pesticides,

polychlorinated biphenyls, volatile organics, extractable organics, and other groups of compounds as necessary. Facilities for extraction of soil and sludge samples include Soxhlet.

E & E uses two types of instruments for analysis of metals in various matrices: AAS and ICAP. The various AAS techniques include application of flame, furnace, cold vapor, and hydride generation procedures. During sample preparation and analysis, ASC staff are especially careful to avoid the matrix interference effects to which the analysis of solid samples (soil, sediment, and sludge) for trace metals is particularly susceptible. Check standards (either EPA-provided or National Bureau of Standards [NBS]-traceable) are used with each set of prepared samples.

Other instruments in the ASC include a total organic carbon analyzer; specific ion electrodes (fluoride, cyanide, nitrate, ammonia); spectrophotometers; and basic items such as pH and conductivity meters.

Key ASC Personnel

Table 3-1 lists the key individuals from the ASC involved in the QC aspect of the program.

Table 3-1

KEY ASC PERSONNEL

Name	Position	Education
Andrea P. Schuessler	Corporate QA Officer	B.S. Chemistry
Andrew P. Clifton	Director, Analytical Services Center	B.S. Chemistry
Gary E. Hahn	Manager, Analytical Services Center	B.S. Chemistry
Caryn A. Wojtowicz	Organic Analysis Supervisor	B.A. Biology
Robert E. Bosshart	Inorganic Analysis Supervisor	B.S. Chemistry B.A. Administrative and Management Sciences
Anthony E. Bogolin	Reports Coordinator	B.S. Environmental Science/Biology

4. QA OBJECTIVES FOR MEASUREMENT DATA

All measurements will be made to ensure that analytical results are representative of the media and conditions measured. Unless otherwise specified, all data will be calculated and reported in units consistant with other organizations reporting similar data to allow comparability of data bases among organizations. Data will be reported in ug/l and mg/l for aqueous samples and ug/kg and mg/kg for soils.

The characteristics of major importance for the assessment of generated data are accuracy, precision, completeness, representativeness, and comparability. Accuracy and precision goals for the Dead Creek project are included in the QC tables in Section 8 of this document. The characteristics are defined as follows.

4.1 ACCURACY

Accuracy is the degree of agreement of a measurement or average of measurements with an accepted reference or "true" value and is a measure of bias in the system. Accuracy determination for this project will be accomplished through a systematic analysis of Standard Reference Materials (SRMs) for calibration and spiking solutions. Obtained values will be compared to "true" values using accepted statistical techniques to provide continuing verification of analytical accuracy. For additional information on analytical procedures and specific routine procedures for data assessment, refer to Sections 8 and 13 of this document. Tables 4-1 and 4-2 include spike recovery limits for data accuracy.

Table 4-1

CONTRACT REQUIRED SURROGATE SPIKE RECOVERY LIMITS*

Fraction	Surrogate Compound	Low/Medium Water	Low/Medium Soil/Sediment
VOA	Toluene-d_8	88 - 110	81 - 117
VOA	4-bromofluorobenzene	86 - 115	74 - 121
VOA	1,2-dichloroethane-d_4	76 - 114	70 - 121
BNA	Nitrobenzene-d_5	35 - 114	23 - 120
BNA	2-fluorobiphenyl	43 - 116	30 - 115
BNA	p-terphenyl-d_{14}	33 - 141	18 - 137
BNA	Phenol-d_5	10 - 94	24 - 113
BNA	2-fluorophenol	21 - 100	25 - 121
BNA	2,4,6-tribromophenol	10 - 123	19 - 122
Pest	Dibutylchlorendate	(24 - 154)**	(20 - 150)**

*Referenced - USEPA Contract Laboratory Program, revised July 1985.

**These limits are for advisory purposes only. They are not used to determine if a sample should be reanalyzed. When sufficient data becomes available, the USEPA may set performance based contract required windows.

Table 4-2

MATRIX SPIKE RECOVERY LIMITS*

Fraction	Matrix Spike Compound	Water*	Soil/ Sediment
VOA	1,1-dichloroethane	61 - 145	59 - 172
VOA	Trichlorethene	71 - 120	62 - 137
VOA	Chlorobenzene	75 - 130	60 - 133
VOA	Toluene	76 - 125	59 - 139
VOA	Benzene	76 - 127	66 - 142
BN	1,2,4-trichlorobenzene	39 - 98	38 - 107
BN	Acenaphthene	46 - 118	31 - 137
BN	2,4-dinitrotoluene	24 - 96	28 - 89
BN	Pyrene	26 - 127	35 - 142
BN	N-nitroso-di-n-propylamine	41 - 116	41 - 126
BN	1,4-dichlorobenzene	36 - 97	28 - 104
BN	Di-n-butyl phthalate	11 - 117	29 - 135
Acid	Pentachlorophenol	9 - 103	17 - 109
Acid	Phenol	12 - 89	26 - 90
Acid	2-chlorophenol	27 - 123	25 - 102
Acid	2-chloro-3-methylphenol	23 - 97	26 - 103
Acid	4-nitrophenol	10 - 80	11 - 114
Pest	Lindane	56 - 123	46 - 127
Pest	Heptachlor	40 - 131	35 - 130
Pest	Aldrin	40 - 120	34 - 132
Pest	Dieldrin	52 - 126	31 - 134
Pest	Endrin	56 - 121	42 - 139
Pest	4,4'-DDT	38 - 127	23 - 134

*Referenced - USEPA Contract Laboratory Program - revised July 1985.

Note: These limits are for advisory purposes only.

4.2 PRECISION

Precision is the degree of mutual agreement among individual measurements of a given parameter. Precision determination will be accomplished through regular analysis of duplicate or replicate samples. Relative Percent Difference (RPD) will be calculated for all duplicates and replicates analyzed. EPA has established acceptable RPDs for many of the parameters to be analyzed in this project. These will be compared to obtained RPDs to provide a continuing verification of analytical precision. Generally, RPD limits for inorganic parameters include a limit of less than or equal to 20%. Refer to Section 13 of this document for specific routine procedures for data assessment. Tables 4-3 and 4-4 include organic RPD limits for data precision.

4.3 COMPLETENESS

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions. Ninety-five percent completeness will be required for each analysis and as an overall project objective.

4.4 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Careful choice and use of appropriate methods will ensure that samples are representative. This is relatively easy with water or air samples, since these components are homogeneously dispersed. In soil and sediment, contaminants are unlikely to be evenly distributed, and thus it is important for the sampler to exercise good judgment when removing a sample.

4.5 COMPARABILITY

Comparability expresses the confidence with which one data set can be compared to another.

Table 4-3

WATER MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Fraction	Compound	Relative Percent Difference (RFP)	Spike Recovery (%)
VOA	1,1-dichloroethane	14	61/145
VOA	Trichlorethene	14	71/120
VOA	Chlorobenzene	13	75/130
VOA	Toluene	13	76/125
VOA	Benzene	11	76/127
B/N/A	1,2,4-trichlorobenzene	28	39/98
B/N/A	Acenaphthene	31	46/118
B/N/A	2,4-dinitrotoluene	38	24/96
B/N/A	Pyrene	31	26/127
B/N/A	N-nitroso-di-n-propylamine	38	41/116
B/N/A	1,4-dichlorobenzene	28	36/97
B/N/A	Pentachlorophenol	50	9/103
B/N/A	Phenol	42	12/89
B/N/A	2-chlorophenol	40	27/123
B/N/A	4-chloro-3-methylphenol	42	23/97
B/N/A	4-nitrophenol	50	10/80
Pesticide	Lindane	15	56/123
Pesticide	Heptachlor	20	40/131
Pesticide	Aldrin	22	40/120
Pesticide	Dieldrin	18	52/126
Pesticide	Endrin	21	56/121
Pesticide	4,4'-DDT	27	38/127

*Referenced - USEPA Contract Laboratory Program, revised July 1985.

Table 4-4

SOIL MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Fraction	Compound	Relative Percent Difference (RFP)	Spike Recovery (%)
VOA	1,1-dichloroethene	22	59/172
VOA	Trichlorethene	24	62/137
VOA	Chlorobenzene	21	60/133
VOA	Toluene	21	59/139
VOA	Benzene	21	66/142
B/N/A	1,2,4-trichlorobenzene	23	38/107
B/N/A	Acenaphthene	19	31/137
B/N/A	2,4-dinitrotoluene	47	28/89
B/N/A	Pyrene	36	35/142
B/N/A	N-nitroso-di-n-propylamine	38	41/126
B/N/A	1,4-dichlorobenzene	27	28/104
B/N/A	Pentachlorophenol	47	17/109
B/N/A	Phenol	35	26/90
B/N/A	2-chlorophenol	50	25/102
B/N/A	4-chloro-3-methylphenol	33	26/103
B/N/A	4-nitrophenol	50	11/114
Pesticide	Lindane	50	46/127
Pesticide	Heptachlor	31	35/130
Pesticide	Aldrin	43	34/132
Pesticide	Dieldrin	38	31/134
Pesticide	Endrin	45	42/139
Pesticide	4,4'-DDT	50	23/134

*Referenced - USEPA Contract Laboratory Program, revised July 1985.

5. SAMPLING PROCEDURES

5.1 AIR INVESTIGATION

The air investigation will include:

- Surveying of sites for "hot spot" off-gassing:
- Identifying and quantifying air releases; and
- Determining background contaminant levels.

The air investigation will include two phases: preliminary source identification and remedial air investigation.

A meteorological station will be set up prior to on-site work to provide baseline data concerning wind direction and speed. This information will be used to determine locations for perimeter monitoring. A baseline volatile organic vapor survey will be conducted on the site prior to any sampling effort to identify areas where potential air problems may exist.

Each site then will be surveyed with an HNu, OVA, or other monitoring equipment. Instrument readings will be recorded for subsequent review and analysis. During this baseline survey, the presence and location of any staining on the ground or exposed waste materials will also be noted and recorded in the field logbooks. An assessment of the vegetative cover on each site will also be made to assist in the planning of additional particulate studies. OVA and HNu values will be recorded for further evaluation.

To achieve the optimum level for the presence of volatile organics in the air, the baseline volatile organic vapor survey should

be conducted when ambient air conditions would provide the highest levels. Best results will occur when the air temperature exceeds 80°F and the wind speed is below five miles per hour (mph). Additionally, this baseline survey should be preceded by at least several days of warm weather. Upon completion of this baseline survey, the data will be reviewed with respect to historical information collected regarding waste types and disposal practices.

After all the sites have been surveyed, additional work may be scheduled for those sites demonstrating contaminant air releases. This will entail quantifying and qualifying the exact nature of contaminants being released. High-volume particulate samplers (for detecting metals and low or semi-volatile organic compound contaminants) and Tenax tube collectors (for detecting volatile contaminants) will be set up in at least one upwind and two downwind locations from each area to be investigated. Several additional stations may be distributed to identify base levels of contaminants. High-volume filters and Tenax tubes will be shipped to E & E's Analytical Services Center (ASC) for analysis.

Additional air monitoring data can be inferred from the soil gas monitoring investigation. In this study, volatile substances are traced in the vadose zone. Data from this study can be extrapolated to indicate areas of probable emission of contaminants to the air through natural volatilization.

5.2 SURFACE SOIL SAMPLING

Surface soil samples will be collected according to the procedures described below:

- Samples will be collected to a depth not to exceed 1 foot.
- Using a stainless steel coring device, soil samples will be collected from the ground surface.
- The samples will be transferred to an 8-ounce wide-mouth glass container. As many scoops as necessary will be taken until the sampling bottle is filled.

- When tools are to be reused to collect a new sample, they will be decontaminated to avoid cross-contamination.

- Any observable physical characteristics of the soil as it is being sampled (e.g., color, odor, physical state) will be recorded.

- Selected samples will be screened in the field using an OVA. This screening process involves filling a volatile organics bottle half full with sample material and capping the bottle, then heating the bottle in a pan of water, then uncapping the bottle and inserting the OVA probe into the head space and taking a reading.

- When compositing is to be done, it will be done by delineating the areas to be composited and collecting sufficient core samples to characterize the area. Equipment used to collect subsamples for a composite will not need to be decontaminated. However, complete decontamination will be conducted prior to use of tools for another composite. Delineation of the areas will be based on field observations of site scope, soil material, visual observations of contaminants, etc. in the case of the grid sampling, samples will be from within a grid section.

- All pertinent weather information such as air temperature, pressure, wind velocity, sky conditions, and precipitation will be recorded.

5.3 SUBSURFACE SOIL SAMPLING

Subsurface sampling will be conducted using a drill rig with a hollow stem auger. Continuous samples will be collected unless subsurface conditions prevent such sampling. Continuous sampling is done using a 4-inch diameter, 5-foot split-spoon sampler with a catcher at the foot locked into the lead auger flight. Retrieval is accomplished using hex rods through the augers. The sampler is advanced by rotating augers to the desired depth.

If field conditions prevent use of this method, a 2-inch diameter, 18-inch split-spoon will be advanced by conventional methods. This will include attachment of the sampler to an AW rod and a standard 140-pound hammer. Blow counts will be recorded at 6-inch intervals to a total sample depth of 18 inches. Borings will be drilled to depths specified in Section 2.3, unless sample screening dictates stopping at shallower depths.

As samples are retrieved, they will be screened with an OVA and the HNu if deemed necessary. Upon completion of logging, the lithology, the sample will be stored in a clean 8-ounce jar. Compositing will be performed at the hotline.

All drilling and sampling equipment to be reused will be decontaminated as specified in Section 9. When samples are to be composited, mixing will be done using stainless steel containers and tools. These also will be decontaminated between uses. Where possible and appropriate, disposable equipment will be used in order to minimize cross contamination. Prior to the start of the sampling work, all drilling tools and equipment will be washed with high-pressure steam equipment and rinsed with solvent (see Section 9).

As noted above, selected samples will be field-screened using an OVA and the HNu. A preliminary survey will be also conducted by "sniffing" the sample with an OVA and the HNu immediately upon opening the sampling tube.

Upon completion of the drilling, the open hole will be backfilled with drill cuttings or grouted. Any deficit of material will be supplied using clean earthen material. When the water table is encountered while drilling or the boring goes below the fill, grout will be used to seal that portion of the boring. Grout will be mixed and pumped from the mud tub through the hollow stem of the auger as the auger is retrieved. The hole will be filled from the top of the grout line to ground level using drill cuttings. Any excess cuttings will be drummed and disposed of in accordance with applicable regulations.

Subsurface Soil Sample Compositing

Compositing of soil samples will be according to the following procedures:

- Each portion from a depth interval to be composited will be thoroughly mixed in its sample container with a stainless steel tablespoon.

- The material will be chopped, mixed, and stirred until it is homogeneous.

- A stainless steel tablespoon will be used to transfer the material to a composite container. A clean stainless steel tablespoon will be dedicated for materials for each composite.

- The composite container will be sealed and labeled as specified in this plan (Section 7.3).

5.4 GROUNDWATER SAMPLING

Sampling of the existing monitoring wells, residential wells, and newly installed monitoring wells will consist of the following three activities:

- Measurement of depth to water level and total depth of the well (to calculate well volume),

- Evacuation of static water (purging), and

- Collection of the sample.

These activities are described below.

5.4.1 Measurement of Water Level and Well Volume

- Prior to sampling, the static water level and total depth of the well will be measured with a calibrated weighted line. Care will be taken to decontaminate equipment between each use to avoid cross contamination of wells.

- The number of linear feet of static water (difference between static water level and total depth of well) will be calculated.

- The static volume will be calculated using the formula:

$$V = Tr^2(0.163)$$

where:

V = Static volume of well in gallons;

T = Depth of water in the well, measured in feet;

r = Inside radius of well casing in inches; and

0.163 = A constant conversion factor which compensates for r^2 h factor for the conversion of the casing radius from inches to feet, the conversion of cubic feet to gallons, and (pi).

5.4.2 Purging Static Water

Before a groundwater sample is obtained, the static water must be purged to ensure that a representative groundwater sample is taken. A minimum of three static water volumes will be purged from the well prior to collecting the samples. Purging and sampling will be performed using a stainless steel bailer. Since the water removed from the well during the purging process could contain hazardous materials, it will be containerized, not discharged on the ground.

5.4.3 Sample Collection

Sampling personnel will take precautions against cross contamination when using one sampling apparatus for a series of samples. If possible, "clean" or "background" samples will be taken first. Before and after each sample is taken, the apparatus will be decontaminated as specified. Sample collection procedures are as follows:

- A stainless steel bailer (decontaminated according to the procedures presented in Section 9) will be used to collect the groundwater samples.

- Dedicated bailers will be used for monitoring wells. Residential well samples will be collected from existing plumbing as close as possible to the pump and prior to any water softening apparatus.

- When transferring water from the bailer to sample containers, care will be taken to avoid agitating the sample, which promotes the loss of volatile constituents.

- Samples to be analyzed for metals will be filtered in the field using a .45-micron filter and preserved with nitric acid prior to shipment for analysis. Filtering equipment used will be decontaminated between samples to avoid cross contamination. Field filtration requires particular skill if contamination is to be avoided.

- Any observable physical characteristics of the groundwater (e.g., color, sheen, odor, turbidity,) as it is being sampled will be recorded.

- Weather conditions at the time of sampling will be recorded (e.g., air temperature, sky condition, recent heavy rainfall, drought conditions).

5.5 SURFACE WATER/SEDIMENT SAMPLING

5.5.1 Surface Water Sampling

Surface water samples will be collected according to the following procedures:

- A wide-mouth glass bottle to be used for sampling will be dipped into the creek and rinsed three times and the bottle will then be dipped to collect the sample.

- The sample will be collected in such a manner as to prevent agitation of the water, which promotes the loss of volatile organics and increases the dissolved oxygen content.

- The samples will be transferred into 1/2-gallon glass bottles and 40-ml VOA bottles. The wide-mouth bottle will be refilled as many times as necessary to fill all required bottles.

- The temperature, pH, and specific conductivity of the water will be measured, and current speed/volume will be recorded at the time the sample is taken.

- Any observable physical characteristics of the water (e.g., color, odor, turbidity) as it is being sampled will be recorded.

- Weather conditions at the time of sampling will be recorded, (e.g., air temperature, sky conditions, recent heavy rainfalls, and drought conditions).

5.5.2 Sediment Sampling

Sediment samples will be collected from Dead Creek using a Peterson dredge or stainless steel corers. The sampling procedure will be as follows:

- The Peterson dredge will be decontaminated as specified in Section 9.

- The dredge will be lowered into the creek sediment until sufficient resistance is encountered to release the retainer catch. The dredge will then be withdrawn from the sediments.

- The contents of the dredge will be placed in a clean stainless steel pan and composited. A composite sample of the sediment will be transferred to an 8-ounce jar.

5.6 SOIL GAS SURVEY

Soil gas analyses will be performed along a grid covering a pre-surveyed area. Results will be compiled and plotted on a site base map. Areas with high readings may be resurveyed at smaller intervals.

One sample will be taken outside the area of contamination to establish background levels.

Experience with soil gas monitoring has shown that the weather conditions most conducive to a successful survey are warm, dry, low-wind conditions following several days of warm to hot weather. The survey will be planned for such conditions.

The survey will consist of three soil gas samples taken at 4, 7, and 10 feet below the surface at each sampling location. Although sample locations have generally been identified, the exact locations will be determined in the field based upon an assessment of field conditions, surface evidence of past dumping practices and contamination, and topographic relief.

The soil gas survey will be conducted using either a slam bar/OVA technique or a perforated drive point/bag method. The slam bar technique uses a steel rod that is driven into the soil with a weight that slides along the top of the rod. The slam bar will be driven into the soil to a depth of three feet or to maximum penetration. When the slam bar is withdrawn, the air in the resultant hole will be analyzed with an OVA for volatile organic compounds.

The primary equipment to be used for the perforated drive point/tube/bag method consists of the following:

1. A miniature well point sampler, 5/8-inch in diameter, stainless steel, with 3/8-inch hollow center. The shaft is tipped with a sharp penetrating point and has a narrow, vertically slotted screen. The internal-thread 2.5-foot sections are driven into the soil using a special cylindrical hammer. Connectors allow hook-up to various types of sample analysis equipment.

2. An OVA for determining the total concentration of organic vapors using a flame ionization detector.

The following procedures will be followed at each of the sampling locations.

1. A decontaminated well point sampler will initially be driven into the soil to a depth of 4 feet at each location.

2. Sample tube fittings will be attached to the samples and one volume of air purged from the system using a syringe or piston displacement device.

3. A sample collection bag will be attached to the system and the bag will be filled using a syringe or piston displacement device. The sample bag will then be carried to a van for analysis.

4. The OVA will be set up and operated in the van to standardize analytical conditions. Bag samples will be allowed to equilibrate with internal van conditions. Once equilibrium has been reached, the bag sample will be connected to the OVA (operated in survey mode) and analyzed for total volatile organic substances. An activated carbon filter will be used to check for the presence of methane. Prior to each set of analyses, the OVA will be "zeroed" in a background area and ambient background readings will be recorded. Temperature readings will be recorded during the background measurement and during the sampling.

5. Depending on field conditions, it may be necessary to substitute a slightly different sample collection and analysis procedure. Should weather and soil conditions preclude the use of the analysis equipment described, the equipment and/or techniques will be modified accordingly. All modifications will be documented and appropriate controls instituted for maintaining sample integrity. In any case, the equivalent of one air volume for each sample and depth will be purged prior to collecting the sample for analysis. If no contaminants are detected in a sample, the sample bags may be reused.

6. Upon completion of sampling at 4 feet, the well point will be blown clear with compressed air (D or E quality) and the well

point will be driven to the next sampling interval (samples will be collected at 4, 7, and 10 feet). Procedures 1 to 5 will be repeated at each interval.

7. Upon completion of sampling at each location, the well point will be withdrawn from the ground and the hole backfilled by injecting a bentonite slurry into it.

8. The well point will be decontaminated as specified in Section 9. The sample analytical equipment tubing will be purged until a stable "zero" or background reading is obtained.

9. All data well point locations and sample results will be recorded in a log book of field activities. Data will be tabulated and plotted on a site base map and used for assessment and planning of future investigative work.

10. A duplicate analysis will be collected after every 20 analyses.

The OVA will be calibrated in accordance with the manufacturer's specifications twice daily, once prior to commencing operations and once after 4 hours of field sampling.

5.7 DECONTAMINATION

Sampling methods and equipment have been chosen to minimize decontamination requirements and the possibility of cross contamination. Any sample tubing, rope, rods, etc., will be disposed of after sampling. Sampling equipment used on more than one location will be decontaminated between locations by following these steps:

- Steam clean (drilling equipment only);
- Scrub with brushes in trisodium phosphate (TSP) solution;
- Rinse with deionized water;
- Rinse with acetone;
- Rinse with hexane;
- Rinse with acetone; and
- Rinse with deionized water.

5.8 SAMPLE CONTAINERS

The volumes and containers required for the sampling activities are included in Tables 5-1 and 5-2. Pre-washed sample containers will be provided by E & E's ASC and prepared in accordance with USEPA bottle washing procedures. These procedures are incorporated in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, ~~April~~ SEPTEMBER 1986.

Table 5-1

SAMPLE CONTAINERS, VOLUMES, PRESERVATION,
AND HOLDING TIMES FOR WATER SAMPLES

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per Sample)	Preservation	Maximum Holding Time
Purgeable (Volatile) Organics	40-ml glass vial with Teflon-backed septum	Two (2); fill completely, no air space	Cool to 4°C (ice in cooler)	7 days
Extractable Organics, PCBs, Pesticides	1/2-gallon bottles with Teflon-lined caps	Two (2); total volume approx. 1 gallon; fill completely	Cool to 4°C (ice in cooler)	Must be extracted within 5 days; analyzed within 30 days
Metals	1-liter polyethylene bottle with polyethylene-lined caps	One (1); fill 7/8 full	Nitric acid to below pH 2 (approx. 1.5 ml Con HNO_3 per liter)	6 months
Cyanides	1-liter polyethylene bottle with polyethylene-lined caps	One (1); fill completely	Sodium hydroxide to pH 12 and cool to 4°C (ice in cooler)	24 hours, if sulfide present; 14 days

Note: All sample bottles will be prepared in accordance with USEPA bottle washing procedures. These procedures are incorporated in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, April 1986.

Table 5-2

SAMPLE CONTAINERS, VOLUMES, PRESERVATION,
AND HOLDING TIMES FOR SOIL SAMPLES

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per Sample)	Preservation	Maximum Holding Time
Purgeable (Volatile) Organics	40-ml glass vial with Teflon-backed septum	Two (2); fill completely, no air space	Cool to 4°C (ice in cooler)	10 days
Extractable Organics, PCBs, Pesticides	8-oz. glass jar with Teflon-lined cap	One (1); fill completely	Cool to 4°C (ice in cooler)	Must be extracted within 10 days; analyzed within 30 days
Metals	8-oz. glass jar with Teflon-lined cap	One (1); fill half-full	Cool to 4°C (ice in cooler)	6 months
Cyanides	8-oz. glass jar with Teflon-lined cap	One (1); fill completely	Cool to 4°C (ice in cooler)	24 hours, if sulfide present;
2,3,7,8 TCDD	8-oz. glass jar with Teflon-lined cap	One (1); fill completely	Cool to 4°C (ice in cooler)	Must be extracted within 5 days; analyzed within 30 days

Note: All sample bottles will be prepared in accordance with USEPA bottle washing procedures. These procedures are incorporated in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, April 1986.

6. SAMPLE CUSTODY

6.1 STANDARD OPERATING PROCEDURES

This section describes standard operating procedures for sample identification and chain-of-custody. The purpose of these procedures is to ensure that the quality of the samples is maintained during their collection, transportation, and storage through analysis. All chain-of-custody requirements comply with standard operating procedures indicated in USEPA sample handling protocol. All sample control and chain-of-custody procedures applicable to the E & E ASC are presented in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, ~~April~~ September 1986.

Sample identification documents must be carefully prepared so that sample identification and chain-of-custody can be maintained and sample disposition controlled. Sample identification documents include:

- Field notebooks;
- Sample label;
- Custody seals; and
- Chain-of-custody records.

6.1.1 Chain-of-Custody

The primary objective of the chain-of-custody procedures is to provide an accurate written record that can be used to trace the

possession and handling of a sample from the moment of its collection through its analyses. A sample is in custody if it is:

- In someone's physical possession;
- In someone's view;
- Locked up; or
- Kept in a secured area that is restricted to authorized personnel.

Field Custody Procedures

- As few persons as possible should handle samples.

- The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another person or dispatched properly.

- The sample collector will record sample data in the field notebook.

- The site team leader will determine whether proper custody procedures were followed during the fieldwork and decide if additional samples are required.

Sample Tags

Sample tags attached to or affixed around the sample container must be used to properly identify all samples taken in the field. The sample tags are to be placed on the bottles so as not to obscure any QA/QC data on the bottles; sample information must be printed in a legible manner using waterproof ink. Field identification must be sufficient to enable cross-reference with the logbook. For chain-of-custody purposes, all QC samples are subject to exactly the same custodial procedures and documentation as "real" samples.

Chain-of-Custody Record

The chain-of-custody record must be fully completed in duplicate, using black carbon paper where possible, by the field technician who

has been designated by the project manager as responsible for sample shipment to the appropriate laboratory for analysis. In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (e.g., extraction time or sample retention period limitations, etc.), the person completing the chain-of-custody record should note these constraints in the "Remarks" section of the custody record.

Transfer of Custody and Shipment

- Samples must be accompanied by a chain-of-custody record. When transferring samples, the individuals relinquishing and receiving them must sign, date, and note the time on the record. This record documents sample custody transfer.

- Samples must be dispatched to the ASC for analysis with a separate chain-of-custody record accompanying each shipment. Shipping containers must be sealed with custody seals for shipment to the laboratory. The method of shipment, name of courier, and other pertinent information are entered in the "Remarks" section of the chain-of-custody record.

- All shipments must be accompanied by the chain-of-custody record identifying their contents. The original record accompanies the shipment, and the yellow copy is retained by the site team leader.

- If sent by mail, the package is registered with return receipt requested. If sent by common carrier, a bill of lading is used. Freight bills, Postal Service receipts, and bills of lading are retained as part of the permanent documentation.

Laboratory Custody Procedures. A designated sample custodian accepts custody of the shipped samples and verifies that the sample identification number matches that on the chain-of-custody record. Pertinent information as to shipment, pickup, and courier is entered in the "Remarks" section. The custodian then enters sample

identification number data into a bound logbook, which is arranged by a project code and station number.

Custody Seals

Custody seals are preprinted adhesive-backed seals with security slots designed to break if the seals are disturbed. A custody seal is placed over the cap of individual sample bottles by the sampling technician. Sample shipping containers (coolers, cardboard boxes, etc., as appropriate) are sealed in as many places as necessary to ensure security. Seals must be signed and dated before use. On receipt at the laboratory, the custodian must check (and certify, by completing logbook entries) that seals on boxes and bottles are intact. Strapping tape should be placed over the seals to ensure that seals are not accidentally broken during shipment.

6.1.2 Documentation

Sample Identification

All containers of samples collected from the Dead Creek project will be identified using the following format on a label or tag fixed to the sample container (labels are to be covered with Mylar tape):

DC-XX-00/D

- DC - This set of initials indicates the sample is from the Dead Creek project.
- XX - These characters identify the sample location. Actual sample locations will be recorded in the task log.
- O/D - This character will be either "O" for original sample, or "D" for duplicate.

Each sample will be labeled and sealed immediately after collection. To minimize handling of sample containers, labels will be filled out prior to sample collection. The sample label will be filled out using waterproof ink and will be firmly affixed to the

sample containers and protected with Mylar tape. The sample label will give the following information:

- Date,
- Sample number,
- Sample volume,
- Analysis required,
- pH, and
- Preservation.

Daily Logs

Daily logs and data forms are necessary to provide sufficient data and observations to enable participants to reconstruct events that occurred during the project and to refresh the memory of the field personnel if called upon to give testimony during legal proceedings. All daily logs will be kept in a bound waterproof notebook containing numbered pages. All entries will be made in waterproof ink, dated, and signed. No pages will be removed for any reason. Corrections will be made according to the procedures given at the end of this section. The daily logs will include a site log and a task log.

The Site Log is the responsibility of the site team leader and will include a complete summary of the day's activity at the site.

The Task Log will include:

- Name of person making entry (signature).
- Names of team members on-site.
- Levels of personnel protection:
  - Level of protection originally used,
  - Changes in protection, if required, and
  - Reasons for changes.
- Time spent collecting samples.
- Weather conditions.
- Documentation on samples taken, including:
  - Sampling location and depth station numbers;
  - Sampling date and time, sampling personnel; and

- Type of sample (grab, composite, etc.), matrix.

- On-site measurement data.
- Field observations and remarks.
- Weather conditions, wind direction, etc.
- Unusual circumstances or difficulties.
- Initials of person recording the information.

Corrections to Documentation

Notebook

As with any data logbooks, no pages will be removed for any reason. If corrections are necessary, these must be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside. The correction must be initialed and dated. Most corrected errors will require a footnote explaining the correction.

Sampling Forms

As previously stated, all sample identification tags, chain-of-custody records, and other forms must be written in waterproof ink. None of these documents are to be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document.

If an error is made on a document assigned to one individual, that individual may make corrections simply by crossing a line through the error and entering the corrected information. The incorrect information should not be obliterated. Any subsequent error discovered on a document should be corrected by the person who made the entry. All corrections must be initialed and dated.

Photographs

Photographs will be taken as directed by the team leader. Documentation of a photograph is crucial to its validity as a representation of an existing situation. The following information will be noted in the task log concerning photographs:

- Date, time, location photograph was taken,

- Photographer (signature),
- Weather conditions,
- Description of photograph taken,
- Reasons why photograph was taken,
- Sequential number of the photograph and the film roll number, and
- Camera lens system used.

After the photographs have been developed, the information recorded in the field notebook should be transferred to the back of the photographs.

6.1.3 Sample Handling, Packaging, and Shipping

The transportation and handling of samples must be accomplished in a manner that not only protects the integrity of the sample but also prevents any detrimental effects due to the possible hazardous nature of samples. Regulations for packaging, marking, labeling, and shipping hazardous materials are promulgated by the United States Department of Transportation (DOT) in the Code of Federal Regulations, 49 CFR 171 through 177.

All chain-of-custody requirements must comply with standard operating procedures in the USEPA sample handling protocol. All sample control and chain-of-custody procedures applicable to the E & E Analytical Services Center (ASC) are presented in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, ~~April~~ September 1986.

Sample Packaging

Samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. The following sample packaging requirements will be followed:

- Sample bottle lids must never be mixed. All sample lids must stay with the original containers. Custody seals must be affixed.

- The sample volume level can be marked by placing the top of the label at the appropriate sample height, or with a grease pencil. This procedure will help the laboratory to determine if any leakage occurred during shipment. The label should not cover any bottle preparation QA/QC marks.

- All sample bottles must be secured with a custody seal and placed in a plastic bag to minimize the potential for vermiculite contamination.

- Shipping coolers must be partially filled with packing materials to prevent the bottles from moving during shipment.

- The secured sample bottles must be placed in the cooler in such a way as to ensure that they do not touch one another.

- The environmental samples are to be cooled. The use of "blue ice" or some other artificial icing material is preferred. If necessary, ice may be used, provided that it is placed in plastic bags. Ice is not to be used as a substitute for packing materials.

- Any remaining space in the cooler should be filled with inert packing material. Under no circumstances should material such as sawdust, sand, etc., be used.

- A duplicate custody record must be placed in a plastic bag and taped to the bottom of the cooler lid.

Note: The ASC does not knowingly accept samples with high levels of radioactivity or dioxins, or any samples for which ASC handling procedures may be insufficient to protect laboratory employees. Project staff and field staff must take all feasible

precautions, including discussions with site officials and company representatives, and site observations to ensure that neither they nor ASC personnel are exposed to unduly hazardous materials. Note that field staff are (in many cases) equipped with personal protection and breathing apparatus not available to ASC personnel.

Shipping Containers

Environmental samples will be properly packaged and labeled for transport and dispatched for analysis to the Ecology and Environment, Inc., Analytical Services Center located at 4285 Genesee Street, Buffalo, New York, 14225. A separate chain-of-custody record must be prepared for each container. The following requirements for shipping containers will be followed.

Shipping containers are to be custody-sealed for shipment as appropriate. The container custody seal will consist of filament tape wrapped around the package at least twice and custody seals affixed in such a way that access to the container can be gained only by cutting the filament tape and breaking a seal.

Field personnel will make arrangements for transportation of samples to the ASC. When custody is relinquished to a shipper, field personnel will telephone the ASC custodian (716/631-0360) to inform him of the expected time of arrival of the sample shipment and to advise him of any time constraints on sample analysis. The ASC must be notified as early in the week as possible, and in no case later than 3 p.m. (eastern time zone) on Thursday, regarding samples intended for Saturday delivery. Samples will be retained by the ASC for 30 days after the final report is submitted.

Marking and Labeling

- Use abbreviations only where specified.

  The words "This End Up" or "This Side Up" must be clearly printed on the top of the outer package. Upward pointing arrows should be placed on the sides of the package. The

words "Laboratory Samples" should also be printed on the top of the package.

- After a container has been sealed, two chain-of-custody seals are placed on the container, one on the front and one on the back. The seals are protected from accidental damage by placing strapping tape over them.

7. CALIBRATION PROCEDURES AND FREQUENCY

All instruments and equipment used during sampling and analysis will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations as well as criteria set forth in the analytical methodology of the Contract Laboratory Program for organic and inorganic analyses. Operation, calibration, and maintenance will be performed by personnel properly trained in these procedures. Documentation of all routine and special maintenance and calibration information will be maintained in an appropriate logbook or reference file and will be available on request. Table 7-1 lists the major instruments to be used for sampling and analysis.

Laboratory capabilities will be initially demonstrated for instrument and reagent/standards performance as well as accuracy and precision of analytical methodology. Daily GC/MS performance tests will be implemented as required and are referenced in the methods to be used.

Table 7-1

LIST OF MAJOR INSTRUMENTS TO BE USED IN THE DEAD CREEK SAMPLING AND ANALYSIS PROGRAM*

- MSA 260 O_2 Explosimeter
- HNu PI-101 Photoionization Analyzer
- Organic Vapor Analyzer Foxboro (128)
- Temperature/Conductivity Meter - Portable
- Hewlett Packard (HP) 1000 computer with RTE-6 operating system; equipped with Aquarius software for control and data acquisition from up to four gas chromatograph/mass spectrometer (GC/MS) systems; combined Wiley and National Bureau of Standards (NBS) mass spectral library; and data archiving on magnetic tape.
- HP5993 GC/MS equipped with packed columns for analysis of volatile organic compounds.
- HP5995C GC/MS equipped with both packed and capillary columns for analysis of all priority pollutant organic compounds.
- HP5970 Mass Spectral Detector interfaced with an HP5890 GC for capillary column determination of semi-volatile priority pollutant compounds.
- Tekmar LSC-2 Liquid Sample Concentrator for volatile organic analysis.
- Hewlett Packard Model 7675A Automated Purge and Trap Sampler.
- Varian 6000 and 3700 Gas Chromatrographs (total 3) equipped with flame ionization, electron capture, photoionization and Hall detectors as appropriate for various analyses
- Spectra-Physics Model SP 4100 and SP 4270 Computing Integrators.
- Instrumentation Laboratory Model 457 Fully Automated Atomic Absorption Spectrophotometer, including a Model 655 Furnace Atomizer.
- Perkin Elmer 5000Z Fully Automated Atomic Absorption Spectrophotometer (AAS) with Furnace Atomizer and Zeeman background correction system.
- Perkin Elmer PE II Inductively Coupled Argon Plasma (ICAP) Spectrometer.

*Calibrated, maintained, and operated according to manufacturer's specifications and all QC protocols within the appropriate methodology. Both lamps (10.2 eV, 11.7 eV) will be used with the HNu Photoionizer. Isobutylene will be used as the calibration gas. The HNu, the OVA, and the MSA 260 O_2 Explosimeter will be calibrated, at a minimum, before use each day, or as required if field problems arise.

8. ANALYTICAL PROCEDURES

Analytical methods to be utilized for the sampling tasks are referenced in USEPA documents: Contract Laboratory Program - Organic Analysis, Statement of Work (SOW), Multimedia, Multiconcentration, Revised July 1985 and Inorganic Analysis, SOW No. 784, July 1984. In addition, groundwater samples from the five residential wells will be analyzed for low-level volatile organic compounds. The gas chromatographic methods to be utilized are referenced within the following documents: the Determination of Halogenated Chemicals in Water by the Purge and Trap Method, Method 502.1, April 1981; and the Analysis of Aromatic Chemicals in Water by the Purge and Trap Method, Method 503.1, May 1980.

Included in Tables 8-1 through 8-5 are detection limits for the GC/MS and GC organic analysis and inorganic (metals) analysis. Tables 8-6 through 8-8 include QC guidelines for inorganic analysis. Refer to sections 4 and 13 of this document for additional QC information regarding spike recovery and RPD limits. Information on sample containers, preservation, and holding times are presented in Section 5 of this document.

Methodology references contain specific QC criteria associated with the particular methods. These specific requirements include calibration, tuning, and QC samples and are described in detail within the methods. Daily performance tests and demonstration of precision and accuracy are required.

In addition, all analytical staff members will follow E & E protocol as set forth in E & E's Laboratory and Field Personnel

Table 8-1*

DEAD CREEK ORGANIC ANALYSIS HAZARDOUS SUBSTANCE LIST (HSL)

Compound	CAS Number	Detection Limits: Low Water (ug/L)	Detection Limits: Low Soil/ Sediment (ug/kg)
Volatiles			
Chloromethane	74-87-3	10	10
Bromomethane	74-83-9	10	10
Vinyl chloride	75-01-4	10	10
Chloroethane	75-00-3	10	10
Methylene chloride	75-09-2	5	5
Acetone	67-64-1	5	10
Carbon disulfide	75-15-0	5	5
1,1-dichloroethene	75-35-4	5	5
1,1-dichloroethane	75-35-3	5	5
trans-1,2-dichloroethene	156-60-5	5	5
Chloroform	67-66-3	5	5
1,2-dichloroethane	107-06-2	5	5
2-butanone	78-93-3	10	10
1,1,1-trichloroethane	71-55-6	5	5
Carbon tetrachloride	56-23-5	5	5
Vinyl acetate	108-05-4	10	10
Bromodichloromethane	75-27-4	5	5
1,1,2,2-tetrachloroethane	79-34-5	5	5
1,2-dichloropropane	78-87-5	5	5
trans-1,2-dichloropropene	10061-02-6	5	5
Trichloroethene	79-01-6	5	5
Dibromochloromethane	124-48-1	5	5
1,1,2-trichloroethane	79-00-5	5	5
Benzene	71-43-2	5	5
cis-2,3-dichloropropene	10061-01-5	5	5
2-chloroethyl vinyl ether	110-75-8	10	10
Bromoform	75-25-2	5	5
2-hexanone	591-78-6	10	10
4-methyl-2-pentanone	108-10-1	10	10
Tetrachloroethene	127-18-4	5	5
Toluene	108-88-3	5	5
Chlorobenzene	108-90-7	5	5
Ethyl benzene	100-41-4	5	5
Styrene	100-42-5	5	5
Total xylenes		5	5

*Referenced - USEPA Contract Laboratory Program, revised July 1985.

Note:

Medium Water Contract Required Detection Limits (CRDL) for Volatile HSL Compounds are 100 times the individual Low Water CRDL.

Medium Soil/Sediment Contract Required Detection Limits (CRDL) for Volatile HSL Compounds are 100 times the individual Low Soil/Sediment CRDL.

Table 8-1 (Cont.)

Compound	CAS Number	Detection Limits Low Water (ug/L)	Detection Limits Low Soil/ Sediment (ug/kg)
Semi-Volatiles			
Phenol	108-95-2	10	330
bis(2-chloroethyl) ether	111-44-4	10	330
2-chlorophenol	95-57-8	10	330
1,3-dichlorobenzene	541-73-1	10	330
1,4-dichlorobenzene	106-46-7	10	330
Benzyl alcohol	100-51-6	10	330
1,2-dichlorobenzene	95-50-1	10	330
2-methylphenol	95-48-7	10	330
bis(2-chloroisopropyl) ether	39638-32-9	10	330
4-methylphenol	106-44-5	10	330
N-nitroso-Dipropylamine	621-64-7	10	330
Hexachloroethane	67-72-1	10	330
Nitrobenzene	98-95-3	10	330
Isophorone	78-59-1	10	330
2-nitrophenol	88-75-5	10	330
2,4-dimethylphenol	105-67-9	10	330
Benzoic acid	65-85-0	50	1,600
bis(2-chloroethoxy) methane	111-91-1	10	330
2,4-dichlorophenol	120-83-2	10	330
1,2,4-trichlorobenzene	120-82-1	10	330
Naphthalene	91-20-3	10	330
4-chloroaniline	106-47-8	10	330
Hexachlorobutadiene	87-68-3	10	330
4-chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330
2-methylnaphthalene	91-57-6	10	330
Hexachlorocyclopentadiene	77-47-4	10	330
2,4,6-trichlorophenol	88-06-2	10	330
2,4,5-trichlorophenol	95-95-4	50	1,600
2-chloronaphthalene	91-58-7	10	330
2-nitroaniline	88-74-4	50	1,600
Dimethyl phthalate	131-11-3	10	330
Acenaphthylene	208-96-8	10	330
3-nitroaniline	99-09-2	50	1,600

Table 8-1 (Cont.)

Compound	CAS Number	Detection Limits: Low Water (ug/L)	Detection Limits: Low Soil/ Sediment (ug/kg)
Semi-Volatiles			
Acenaphthene	83-32-9	10	330
2,4-dinitrophenol	51-28-5	50	1,600
4-nitrophenol	100-02-7	50	1,600
Dibenzofuran	132-64-9	10	330
2,4-dinitrotoluene	121-14-2	10	330
2,6-dinitrotoluene	606-20-2	10	330
Diethylphthalate	84-66-2	10	330
4-chlorophenyl phenyl ether	7005-72-3	10	330
Fluorene	86-73-7	10	330
4-nitroaniline	100-01-6	50	1,600
4,6-dinitro-2-methylphenol	534-52-1	50	1,600
N-nitrosodiphenylamine	86-30-6	10	330
4-bromophenyl phenyl ether	101-55-3	10	330
Hexachlorobenzene	118-74-1	10	330
Pentachlorophenol	87-86-5	50	1,600
Phenanthrene	85-01-8	10	330
Anthracene	120-12-7	10	330
Di-n-butylphthalate	84-74-2	10	330
Fluoranthene	206-44-0	10	330
Pyrene	129-00-0	10	330
Butyl benzyl phthalate	85-68-7	10	330
3,3'-dichlorobenzidine	91-94-1	20	660
Benzo(a)anthracene	56-55-3	10	330
bis(2-ethylhexyl)phthalate	117-81-7	10	330
Chrysene	218-01-9	10	330
Di-n-octyl phthalate	117-84-0	10	330
Benzo(b)fluoranthene	205-99-2	10	330
Benzo(k)fluoranthene	207-08-9	10	330
Benzo(a)pyrene	50-32-8	10	330
Indeno(1,2,3-cd)pyrene	193-39-5	10	330
Dibenz(a,h)anthracene	53-70-3	10	330
Benzo(g,h,i)perylene	191-24-2	10	330

Note:

Medium Water Contract Required Detection Limits (CRDL) for Semi-Volatile HSL Compounds are 100 times the individual Low Water CRDL.

Medium Soil/Sediment Contract Required Detection Limits (CRDL) for Semi-Volatile HSL Compounds are 60 times the individual Low Soil/Sediment CRDL.

Table 8-1 (Cont.)

Compound	CAS Number	Detection Limits: Low Water (ug/L)	Detection Limits: Low Soil/ Sediment (ug/kg)
Pesticides and Polychlorinated Biphenyls (PCBs)			
alpha-BHC	319-84-6	0.05	8
beta-BHC	319-85-7	0.05	8
delta-BHC	319-86-8	0.05	8
gamma-BHC (lindane)	58-89-9	0.05	8
Heptachlor	76-44-8	0.05	8
Aldrin	309-00-2	0.05	8
Heptachlor Epoxide	1024-57-3	0.05	8
Endosulfan I	959-98-8	0.05	8
Dieldrin	60-57-1	0.10	16
4,4'-DDE	72-55-9	0.10	16
Endosulfan II	33213-65-9	0.10	16
4,4'-DDD	72-54-8	0.10	16
Endosulfan Sulfate	1031-07-8	0.10	16
4,4'-DDT	50-29-3	0.10	16
Endrin Ketone	53494-70-5	0.10	16
Methoxychlor	72-43-5	0.5	80
Chlordane	57-74-9	0.5	80
Toxaphene	8001-35-2	1.0	160
Aroclor-1016	12674-11-2	0.5	80
Aroclor-1221	11104-28-2	0.5	80
Aroclor-1232	11141-16-5	0.5	80
Aroclor-1242	53469-21-9	0.5	80
Aroclor-1248	12672-29-6	0.5	80
Aroclor-1254	11097-69-1	1.0	160
Aroclor-1260	11096-82-5	1.0	160

Notes:

Medium Water Contract Required Detection Limits (CRDL) for Pesticide/PCB HSL Compounds are 100 times the individual Low Water CRDL.

Medium Soil/Sediment Contract Required Detection Limits (CRDL) for Pesticide/PCB HSL compounds are 15 times the individual Low Soil/Sediment CRDL.

Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, as required by the contract, will be higher.

Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.

Table 8-2

METHOD DETECTION LIMITS (MDLs)
FOR SELECTED ORGANOHALIDES

Compound	MDL^A (ug/l)	MDL^B (ug/l)
Methyl chloride	0.01	0.001
Vinyl chloride	0.006	0.01
Methyl bromide	0.1	0.03
Ethyl chloride	0.008	0.003
1,1-dichloroethylene	0.003	0.003
1,1-dichloroethane	0.002	0.003
Methylene chloride*	--	--
cis+trans-1,2-dichloroethylene	0.002	0.002
Chloroform	0.002	0.002
1,2-dichloroethane	0.002	0.002
1,1,1-trichloroethane	0.003	0.001
Carbon tetrachloride	0.003	0.002
Bromodichloromethane	0.002	0.003
Dichloroacetonitrile	0.04	0.04
1,1,2-trichloroethylene	0.0007	0.0006
Chlorodibromomethane	0.005	0.008
1,1,2-trichloroethane	0.007	0.002
1,2-dibromoethane	0.03	0.04
2-chloroethylvinyl ether	0.07	0.02
2-chloroethylethyl ether	0.02	0.01
Bromoform	0.02	0.05
1,1,2,2-tetrachloroethane	0.01	0.004
1,1,2,2-tetrachloroethylene	0.001	0.001
Chlorobenzene	0.001	0.005
1,2-dibromo-3-chloropropane	0.03	0.05

MDL^A - Method detection limit at 99% confidence that the value is not zero.

MDL^B - Estimated method detection limit.

*Average background level for methylene chloride 0.1 ug/L.

Reference - USEPA - The Determination of Halogenated Chemicals in Water by the Purge and Trap Method 502.1, EPA #600/4-81-059, April 1981.

Table 8-3

AROMATIC COMPOUNDS
LOWER LIMITS OF DETECTION

Compound	Lower Limit of Detection (ug/l)*
Benzene	0.02
1,1,2-trichloroethylene	0.01
a-trifluorotoluene	0.02
Toluene	0.02
1,1,2,2-tetrachloroethylene	0.01
Ethylbenzene	0.002
1,chlorocyclohexene-1	0.008
p-xylene	0.002
Chlorobenzene	0.004
m-xylene	0.004
o-xylene	0.004
Iso-propylbenzene	0.005
Styrene	0.008
n-propylbenzene	0.009
tert-butylbenzene	0.006
o-chlorotoluene	0.008
Bromobenzene	0.002
sec-butylbenzene	0.02
1,3,5-trimethylbenzene	0.003
p-cymene	0.009
1,2,4-trimethylbenzene	0.006
p-dichlorobenzene	0.006
m-dichlorobenzene	0.006
n-butylbenzene	0.02
2,3-benzofuran	0.03
o-dichlorobenzene	0.02
Hexachlorobutadiene	0.02
1,2,4-trichlorobenzene	0.03
Naphthalene	0.04
1,2,3-trichlorobenzene	0.03

*Lower Limit of Detection = 99% confidence that the value is not zero calculated from 7 runs at 0.04 ug/l.

Reference - USEPA - The Analysis of Aromatic Chemicals in Water by the Purge and Trap Method 503.1, EPA #600/4-81-057, May 1980.

Table 8-4*

ELEMENTS DETERMINED BY INDUCTIVELY COUPLED
PLASMA EMISSION OR ATOMIC ABSORPTION SPECTROSCOPY

Element	Contract Required Detection Level (ug/L)
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5,000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	5
Magnesium	5,000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5,000
Selenium	5
Silver	10
Sodium	5,000
Thallium	10
Tin	40
Vanadium	50
Zinc	20

*Referenced - USEPA Contract Laboratory Program, July 1984.

Table 8-5*

CYANIDE DETERMINATION

Element	Contract Required Detection Level (ug/L)
Cyanide	10

*Referenced - USEPA Contract Laboratory Program, July 1984.

Table 8-6*

INITIAL AND CONTINUING CALIBRATION VERIFICATION
CONTROL LIMITS FOR INORGANIC ANALYSES

Analytical Method	Inorganic Species	% of True Value (EPA Set) Low Limit	High Limit
ICP Spectroscopy/ Flame Atomic Absorption Spectrometry	Metals	90	110
Furnace AA	Metals	90	110
	Tin	80	120
Cold Vapor AA	Mercury	80	120
Other	Cyanide	90	110

*Referenced - USEPA Contract Laboratory Program, July 1984.

Table 8-7*

INTERFERENT AND ANALYTE ELEMENTAL CONCENTRATIONS
USED FOR ICP INTERFERENCE CHECK SAMPLE

Analytes	(mg/L)	Interferents	(mg/L)
Silver	0.5	Aluminum	500
Arsenic	1.0	Calcium	500
Barium	0.5	Iron	500
Beryllium	0.5	Magnesium	500
Cadmium	1.0		
Cobalt	0.5		
Chromium	0.5		
Copper	0.5		
Manganese	0.5		
Nickel	1.0		
Lead	1.0		
Antimony	1.0		
Selenium	1.0		
Thallium	1.0		
Vanadium	0.5		
Zinc	1.0		

*Referenced - USEPA Contract Laboratory Program, July 1984.

Table 8-8

INTERFERENT AND ANALYTE ELEMENTAL CONCENTRATIONS
USED FOR INTERFERENCE MEASUREMENTS IN TABLE 8-7*

Analytes	(mg/L)	Interferents	(mg/L)
Aluminum	10	Aluminum	1,000
Arsenic	10	Calcium	1,000
Boron	10	Chromium	200
Barium	1	Copper	200
Beryllium	1	Iron	1,000
Calcium	1	Magnesium	1,000
Cadmium	10	Manganese	200
Cobalt	1	Nickel	200
Chromium	1	Titanium	200
Copper	1	Vanadium	200
Iron	1		
Magnesium	1		
Manganese	1		
Molybdenum	10		
Sodium	10		
Nickel	10		
Lead	10		
Antimony	10		
Selenium	10		
Silicon	1		
Thallium	10		
Vanadium	1		
Zinc	10		

Note: 100 $\pm$ 20% recovery required for ICP interference check.

*Referenced - USEPA Contract Laboratory Program, Revised July 1984.

Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, ~~April~~ SEPTEMBER 1986.

9. DATA REDUCTION, VALIDATION, AND REPORTING

QA/QC requirements from both methodology and company protocols will be strictly adhered to during sampling and analytical work. All data generated will be reviewed by comparing and interpreting results from chromatograms (responses, stability of retention times), accuracy (mean percent recovery of spiked samples), and precision (reproducibility of results). Refer to Section 10 for detailed discussion of QA/QC protocol.

All calculations and data manipulations are included in the appropriate methodology references. Control charts and calibration curves will be used to review the data and identify outlying results.

Prior to the submission of the report to the client, all data will be evaluated for precision accuracy and completeness. Specific procedures for data validation are included in Exhibit E: Quality Assurance/Quality Control Requirements, in the CLP Statement of Work as referenced in Section 8 of this document. Sections 4, 8, and 13 of this document include some of the quality control criteria to be utilized in the data validation process.

Data storage and documentation will be maintained using logbooks and data sheets that will be kept on file. Analytical and field QC will be documented and included in the report. The central file will be maintained for the sampling and analytical effort for a period of five years after the final report is issued.

Reports will be reviewed by the laboratory supervisor, the QA officer, ASC manager and/or director, and the project manager. The following information will be included in the analytical reports:

1. Scope and Application

   - Type of analyses, parameters of interest, Method Detection Limits (MDLs), acceptance criteria for precision, accuracy, and completeness

2. Analytical Methods (referenced)

3. Method Blank Analysis

   - Types of impurities and contamination

4. Quality Control

   - Demonstration of competence by meeting limits for acceptance criteria for precision, accuracy, and completeness

   - Records kept and reported with sample results

5. Criteria for Quantitative Identification

   - Results reported in ug/l, ug/kg or mg/l, mg/kg

6. Method Verification

   - Demonstration of precision and accuracy

7. Calibration

   - Internal/external standards used

8. Daily Performance Tests for Instrumentation

   - Tuning and calibration

9. Criteria for Qualitative Identification

- Criteria for positive identification

- Chromatograms

The following information will not be included in the analytical reports but are available within the Sampling Plan, QAPP, and Health and Safety documents for the Dead Creek Project.

10. Safety

    - Detailed summary of safety protocols followed

11. Apparatus and Materials

    - Sampling equipment, instruments used for analysis

12. Reagents

    - Types of reagents used, preparation of standard solutions

13. Sampling

    - Techniques used

14. Sample Preservation and Handling

Figure 9-1 presents a Data flow/reporting scheme.

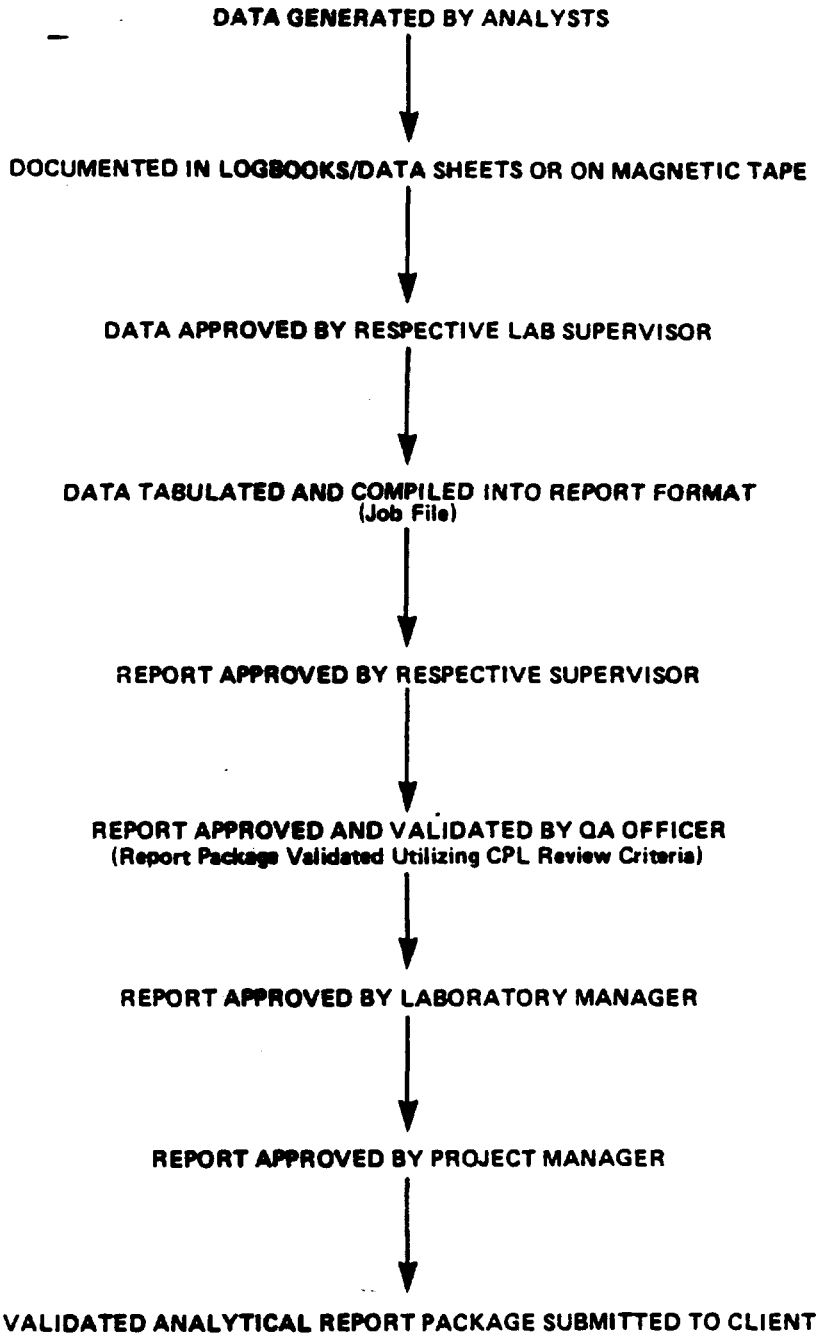

Figure 9–1 DATA FLOW/REPORTING SCHEME

10. INTERNAL QUALITY CONTROL CHECKS

QC data is necessary to determine precision and accuracy and to demonstrate the absence of interferences and/or contamination of glassware and reagents. Laboratory-based QC will comprise at least 10% of each data set generated and will consist of standards, replicates, spikes, and blanks. Depending upon the particular method used, QC may be more rigorous, but at a minimum, one spike or replicate per 10 samples and one method blank per 20 samples or run, whichever is greater, will be utilized for every analytical run. Field duplicates and field blanks will be analyzed by the laboratory as samples and will not necessarily be identified to the laboratory as duplicates or blanks. Split samples in the field will be provided to IEPA upon request to be analyzed independently. Calculations will be performed for recoveries and standard deviations along with review of retention times, response factors, chromatograms, calibration, tuning, and all other QC information generated. All QC data, including split samples, will be documented in the site logbook. QC records will be retained and results reported with sample data. Specific QC requirements for the organic and inorganic analyses are incorporated in USEPA's Contract Laboratory Program, Scope of Work for Organic and Inorganic Analyses.

Blank Samples

Blank samples are analyzed in order to assess possible contamination from the field and/or laboratory so that corrective measures may be taken, if necessary. Blank samples include:

- Field Blanks - These blank samples are exposed to field and sampling conditions and analyzed in order to assess possible contamination from the field.

- Method Blanks - These blank samples are prepared in the laboratory and are analyzed in order to assess possible laboratory contamination.

- Reagent and Solvent Blanks - These blank samples are prepared in the laboratory and analyzed in order to determine the background of each of the reagents or solvents used in an analysis.

Analytical Replicates

Replicate samples are aliquots of a single sample that is split on arrival at the laboratory or upon analysis. Replicates may be made if no duplicates are provided by the field sampling team; however, their purposes are not always interchangeable. Significant differences between two replicates that are split in a controlled laboratory environment usually are due to poor analytical technique.

Calibration Standards

A calibration standard is prepared in the laboratory by dissolving a known amount of a pure compound in an appropriate matrix. The final concentration calculated from the known quantities is the true value of the standard. The results obtained from these standards are used to generate a standard curve and thereby quantitate the compound in the environmental sample. A minimum of three calibration standards will be used to generate a standard curve for all analyses.

Check Standard

A check standard is prepared in the same manner as a calibration standard or may be obtained from USEPA. The final concentration calculated from the known quantities is the "true" value of the standard. The important difference in a check standard is that it is not carried through the same process used for the environmental samples, but is analyzed without digestion or extraction. A check standard result is

used to validate an existing concentration calibration standard file or calibration curve. The check standard can provide information on the accuracy of the instrumental analytical method independent of various sample matrices.

Spike Sample

A sample spike is prepared by adding to an environmental sample (before extraction or digestion), a known amount of pure compound of the same type that is to be assayed for in the environmental sample. These spikes simulate the background and interferences found in the actual samples and the calculated percent recovery of the spike is taken as a measure of the accuracy of the total analytical method. When there is no change in volume due to the spike, it is calculated as follows:

$$\% R = \frac{100\ (O-X)}{T}$$

where, % R = Percent recovery;

O = Measured value of analyte; and

X = Measured value of analyte concentration in the sample before the spike is added.

Tolerance limits for acceptable percent recovery are established in the methodology references and presented in Section 8 of this document.

Internal Standard

An internal standard is prepared by adding a known amount of pure compound to the environmental sample; the compound selected is not one expected to be found in the sample, but is similar in nature to the compound of interest. Internal standards are added to the environmental sample just prior to analysis. (Note: Internal standards and surrogate spikes are different compounds. The internal standard is for quantification purposes using the relative response factor;

surrogate spikes indicate the percent recovery and therefore the efficiency of the methodology.)

Matrix Spike/Duplicate

Aliquots are made in the laboratory of the same sample and each aliquot is treated exactly the same throughout the analytical method. Spikes are added at approximately 10 times the method detection limit. The percent difference between the values of the duplicates, as calculated below, is taken as a measure of the precision of the analytical method:

$$\% D = \frac{2 (D_1 - D_2)}{(D_1 + D_2)} \times 100$$

where, % D = Percent difference,

D_1 = First sample value, and

D_2 = Second sample value (duplicated).

The tolerance limit for percent differences between laboratory duplicates should not exceed 15% for validation in homogeneous samples. Refer to Section 8 for criteria on percent difference. Acceptable percent differences may vary depending on actual levels.

Quality Control Check Samples

Inorganic and organic control check samples are available from USEPA free of charge and are used as a means of evaluating analytical techniques of the analyst.

11. PERFORMANCE AND SYSTEM AUDITS

Performance and system audits include careful evaluation of both field and laboratory quality control. System audits are performed on a regularly scheduled basis during the lifetime of the project to determine the accuracy of the measurement systems.

System audits may be performed through split sampling in the field and issuing the laboratory periodic blind samples. Split samples may be provided and will be documented. The IEPA would compare results of QA split samples analyzed by an independent laboratory with analogous results obtained by E & E on splits of the same samples. Results will be reported to IEPA in a timely manner for this comparison. Blind samples will be analyzed by the laboratory utilizing appropriate analytical methodology and results reported with sample data.

Audits of field activities can be carried out to evaluate sampling activities such as sample identification, sample control, chain-of-custody procedures, field documentation, and general sampling operations.

The Project Manager and QA officer will create a schedule and institute a program for regular system and performance audits.

One field and one laboratory audit will be performed by E & E during the project sampling and analytical activities. The field audit will be performed by an E & E Health and Safety Officer and the laboratory audit by E & E's corporate QA officer. Attachments 1 and 2 provided at the end of Appendix D contain evaluation sheets including a field audit checklist and a laboratory evaluation checklist.

IEPA previously conducted initial performance and system audits during July and August 1985. IEPA will perform a scheduled systems audit during sample analysis for the project.

12. PREVENTIVE MAINTENANCE

All instruments and equipment will be maintained under service agreements with the manufacturers and will be serviced and maintained only by qualified personnel. All repairs, adjustments, and calibrations will be documented in an appropriate logbook or data sheet that will be kept on file.

13. PROCEDURES FOR DATA ASSESSMENT

Performance of the following calculations will be documented and included in the QC section.

13.1 ACCURACY

Accuracy is the difference between an average value and the "true" value when the latter is known or assumed. The term "accuracy" is normally used interchangeably with "percent recovery," and describes either recovery of a known amount of analyte (spike) added to a sample of known value, or recovery of a synthetic standard of known value.

$$\text{Recovery}_{(\text{spike})} = 100 \times \frac{(\text{concentration spike + sample}) - \text{sample}}{\text{concentration spike}}$$

$$\text{Recovery}_{(\text{standard})} = 100 \times \frac{\text{observed value}}{\text{true value}}$$

Average

The average (or arithmetic mean) of a set of "n" values is the sum of the values divided by "n":

$$\bar{X} = \frac{\sum_{1}^{n} X_1}{n}$$

13.2 PRECISION

Relative to the data from a single test procedure, precision is the degree of mutual agreement among individual measurements made under prescribed conditions. An estimate of standard deviation is normally used to describe the precision of a method.

Standard Deviation Estimate

Standard deviation estimate is the most widely used measure to describe the dispersion of a set of data. Normally, $X \pm S$ will include 68%, and $X \pm 2S$ will include about 95%, of the data from a study.

$$S = \sqrt{\frac{\sum_{i=1} (X_i - \bar{X})^2}{n-1}}$$

Relative Standard Deviation

The estimate of precision of a series of replicate measurements will usually be expressed as the relative standard deviation, RSD:

$$RSD = \frac{SD}{\bar{X}} \times 100\%$$

Percent Relative Difference

A measure of the difference between two samples assumed to be identical through dividing (splitting) an original sample, analyzing each portion, identifying the values of the first replicate (X_1) and that of the second replicate (X_2), and dividing the difference by the mean ($\bar{X}$) of x_1 and x_2.

$$RD\ (percent) = 100\ \frac{x_1 - x_2}{\bar{X}}$$

13.3 COMPLETENESS

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the total amount that was expected to be obtained under normal conditions. A 95% completeness figure is usually required for a particular analysis and overall project objective.

14. CORRECTIVE ACTION

Corrective actions can be initiated as a result of performance and system audits, laboratory and interfield comparison studies, specific problems, and/or a QA program audit, to name a few.

Corrective actions may include altering procedures in the field, conducting subsequent audits, or modifying laboratory protocol. Time and type of corrective action, if needed, will depend on the severity of the problem and relative overall project importance. The project manager is responsible for initiating corrective action and the ASC manager/director or the team leader for its implementation.

Precision and accuracy will be regularly tracked by the analytical staff to determine unacceptable results and to evaluate and implement corrective actions. Corrective actions may include but not be limited to recalibration of instruments using freshly prepared calibration standards; replacement of lots of solvent or other reagents that give unacceptable blank values; additional training of laboratory personnel; or reassignment, if necessary. Corrective actions in many cases may need to be defined as the need arises.

If substantial corrective action is required or if serious QA problems are encountered, the IEPA will be notified by phone and in writing as soon as possible. All corrective action will be implemented and documented after notification and approval of IEPA.

15. QUALITY ASSURANCE REPORTS

For the project sampling effort, no separate QA report will be issued. Analytical and QC data will be included in the comprehensive report summarizing data quality information for the entire project.

Reports will include where appropriate, periodic assessments of accuracy, precision and completeness, results of performance and system audits, and significant QA/QC problems and recommended solutions.

Bimonthly reports will be issued summarizing QA/QC activity as well as problems/comments associated with the analytical and sampling effort. Results from split/duplicate samples will be provided to IEPA in a timely manner for comparison of results. Serious analytical problems will be reported to IEPA by phone and in writing as soon as possible.

Attachment 1

FIELD AUDIT CHECKLIST

Ecology and Environment, Inc.

FIELD AUDIT CHECKLIST

Briefing with On-Site Project Manager (SPM)

PROJECT NO. _____ DATE OF AUDIT _____

PROJECT MANAGER _____ SIGNATURE OF AUDITOR _____

OFFICE LOCATION _____

Yes __ No __ N/A __ 1. Was a QA Project Plan and a Site Health and Safety Plan plan prepared? If yes, what items are addressed in the plan?

Comments: _____

_____

_____

Yes __ No __ N/A __ 2. Was a briefing held with project participants?

Comments: _____

_____

_____

Yes __ No __ N/A __ 3. Were additional instructions given to project participants (i.e., changes in project plan)?

Comments: _____

_____

_____

Yes __ No __ N/A __ 4. Is there a written list of sampling locations and descriptions?

Comments: _____

_____

_____

Yes __ No __ N/A __ 5. Is there a map of sampling locations?
Comments: _____

_____

_____

Yes __ No __ N/A __ 6. Does the sampling team follow a system of accountable documents?
If yes, what documents are accountable?
Comments: _____

_____

_____

Yes __ No __ N/A __ 7. Is there a list of accountable field documents checked out to the SPM or designated person?
If yes, who checked them out?
Comments: _____

_____

_____

Yes __ No __ N/A __ 8. Is the transfer of field documents (Sample I.D. Tags, Chain-of-Custody Records, logbooks, etc.) from the SPM to the field participants documented in a logbook?
Comments: _____

_____

_____

FIELD AUDIT CHECKLIST

Field Observations

PROJECT NO. _____ DATE OF AUDIT _____

PROJECT MANAGER _____ SIGNATURE OF AUDITOR _____

OFFICE LOCATION _____

Yes __ No __ N/A __ 1. Was permission granted to enter and inspect the facility/sampling site?

Comments: _____

_____

_____

Yes __ No __ N/A __ 2. Is permission to enter the facility documented?

Comments: _____

_____

_____

Yes __ No __ N/A __ 3. Were split samples offered to the facility/client? If yes, was the offer accepted or declined?

Comments: _____

_____

_____

Yes __ No __ N/A __ 4. If the offer to split samples was accepted, were the split samples collected?

Comments: _____

_____

_____

Yes __ No __ N/A __ 5. Is the offering of split samples recorded?

Comments: _____

_____

_____

Yes __ No __ N/A __ 6. If split samples were collected, are they documented?
If yes, where are they documented?
Comments: _____

Yes __ No __ N/A __ 7. Are the number, frequency, and types of field measurements and observations taken as specified in the project plan or as directed by the SPM?
Comments: _____

Yes __ No __ N/A __ 8. Are field measurements recorded (pH, temperature, conductivity, etc.)? Where?
Comments: _____

Yes __ No __ N/A __ 9. Are samples collected in the types of containers specified in the project plan or as directed by the SPM?
Comments: _____

Yes __ No __ N/A __ 10. Are samples preserved as specified in the Project Plan or as directed by the SPM?
Comments: _____

Yes __ No __ N/A __ 11. Are the number, frequency, and types of samples collected as specified in the Project Plan or as directed by the SPM?

Comments: _____

_____

_____

Yes __ No __ N/A __ 12. Are samples packed for preservation as specified in the Project Plan (i.e., packed in ice, etc.)?

Comments: _____

_____

_____

Yes __ No __ N/A __ 13. Is sample custody maintained at all times?

Comments: _____

_____

_____

FIELD AUDIT CHECKLIST

Document Control

PROJECT NO. _____ DATE OF AUDIT _____

PROJECT MANAGER _____ SIGNATURE OF AUDITOR _____

OFFICE LOCATION _____

Yes __ No __ N/A __ 1. Have all unused and voided accountable documents been returned to the SPM by the team members?

Comments: _____

_____

_____

Yes __ No __ N/A __ 2. Have document numbers of all lost or destroyed accountable documents been recorded in the SPM's logbook?

Comments: _____

_____

_____

Yes __ No __ N/A __ 3. Are all samples identified with Sample I.D. Tags?

Comments: _____

_____

_____

Yes __ No __ N/A __ 4. Are all Sample I.D. Tags completed (e.g., station no., location, date, time, analyses, signatures of samplers, type, preservatives, etc.)?

Comments: _____

_____

_____

Yes __ No __ N/A __ 5. **Are all samples collected listed on a Chain-of-Custody Record?**
If yes, describe the type of Chain-of-Custody Record used.
Comments: _____

Yes __ No __ N/A __ 6. **Are the Sample I.D. Tag numbers recorded on the Chain-of-Custody Records?**
Comments: _____

Yes __ No __ N/A __ 7. **Does information on Sample I.D. Tags and Chain-of-Custody Records match?**
Comments: _____

Yes __ No __ N/A __ 8. **Do the Chain-of-Custody Records indicate the method of sample shipment?**
Comments: _____

Yes __ No __ N/A __ 9. **Is a Chain-of-Custody record included with the samples in the shipping container?**
Comments: _____

Yes __ No __ N/A __ 10. Do the sample traffic reports agree with the Sample I.D. Tags?

Comments: _____

_____

_____

Yes __ No __ N/A __ 11. If required, has a copy of a Receipt-For-Samples form been provided to the facility?

Comments: _____

_____

_____

Yes __ No __ N/A __ 12. If required, was the offer of a receipt for samples documented?

Comments: _____

_____

_____

Yes __ No __ N/A __ 13. If used, are blank samples identified?

Comments: _____

_____

_____

Yes __ No __ N/A __ 14. If collected, are duplicate samples identified on Sample I.D. Tags and Chain-of-Custody Records?

Comments: _____

_____

_____

Yes __ No __ N/A __ 15. If used, are spiked samples identified?

Comments: _____

_____

_____

Yes __ No __ N/A __ 16. **Are Field Notebooks signed by the individual who checked out the notebook from the SPM?**
Comments: _____

Yes __ No __ N/A __ 17. **Are Field Notebooks dated upon receipt from the SPM?**
Comments: _____

Yes __ No __ N/A __ 18. **Are Field Notebooks project-specific (by notebook or by page)?**
Comments: _____

Yes __ No __ N/A __ 19. **Are Field Notebook entries dated and identified by author?**
Comments: _____

Yes __ No __ N/A __ 20. **Is the facility's approval or disapproval to take photographs noted in a Field Notebook?**
Comments: _____

Yes __ No __ N/A __ 21. **Are photographs documented in Field Notebooks (e.g., time, date, description of subject, photographer, etc.)?**
Comments: _____

Yes __ No __ N/A __ 22. If a Polaroid camera is used, are photos matched with Field Notebook documentation?

Comments: _____

_____

_____

Yes __ No __ N/A __ 23. Are Sample I.D. Tag numbers recorded in the SPM logbook?

Comments: _____

_____

_____

Yes __ No __ N/A __ 24. Are Quality Control checks documented (i.e., calibration of pH meters, conductivity meters, etc.)?

Comments: _____

_____

_____

Yes __ No __ N/A __ 25. Are amendments to the Project Plan documented (on the Project Plan itself, in a project logbook, elsewhere)?

Comments: _____

_____

_____

FIELD AUDIT CHECKLIST

Debriefing with SPM or Field Sampling Team Leader

PROJECT NO. _____ DATE OF AUDIT _____

PROJECT MANAGER _____ SIGNATURE OF AUDITOR _____

OFFICE LOCATION _____

Yes __ No __ N/A __ 1. Was a debriefing held with project participants after the audit was completed?

Comments: _____

Yes __ No __ N/A __ 2. Were any recommendations made to project participants during the debriefing?

If yes, briefly describe what recommendations were made.

Comments: _____

DOCUMENT AUDIT CHECKLIST

Closed Files

PROJECT NO. _____ DATE OF AUDIT _____

PROJECT LOCATION _____ SIGNATURE OF AUDITOR _____

OFFICE LOCATION _____

Yes __ No __ N/A __ 1. Have individual files been assembled (field investigation, laboratory, other)?

Comments: _____

_____

_____

Yes __ No __ N/A __ 2. Is each file inventoried?

Comments: _____

_____

_____

Yes __ No __ N/A __ 3. Is a document numbering sytem used?

Comments: _____

_____

_____

Yes __ No __ N/A __ 4. Has each document been assigned a document control number?

Comments: _____

_____

_____

Yes __ No __ N/A __ 5. Are all documents listed on the inventory accounted for?

Comments: _____

_____

_____

Yes __ No __ N/A __ 6. Are there any documents in the file that are not on the inventory?

Comments: _____

_____

_____

Yes __ No __ N/A __ 7. Is the file stored in a secure area?

Comments: _____

_____

_____

Yes __ No __ N/A __ 8. Are there any project documents that have been declared enforcement sensitive?

Comments: _____

_____

_____

DOCUMENT AUDIT CHECKLIST

Enforcement Sensitive Documents

PROJECT NO. _____ DATE OF AUDIT _____

PROJECT LOCATION _____ SIGNATURE OF AUDITOR _____

OFFICE LOCATION _____

Yes __ No __ N/A __ 1. Are Enforcement Sensitive documents stored in a secure area separate from other project documents?

Comments: _____

Yes __ No __ N/A __ 2. Are Enforcement Sensitive documents listed in the project file?

Comments: _____

Yes __ No __ N/A __ 3. Is access to Enforcement Sensitive files restricted?

Comments: _____

Yes __ No __ N/A __ 4. Have classified documents been marked or stamped "Enforcement Sensitive?"

Comments: _____

Yes __ No __ N/A __ 5. Is classified information inventoried?

Comments: _____

Yes __ No __ N/A __ 6. Is classified information numbered for document control?

Comments: _____

_____

_____

DOCUMENT AUDIT CHECKLIST

Active Project Files

PROJECT NO. _____ DATE OF AUDIT _____

PROJECT LOCATION _____ SIGNATURE OF AUDITOR _____

OFFICE LOCATION _____

Yes __ No __ N/A __ 1. Are project notebooks being maintained in accordance with E & E policies?

Comments: _____

_____

_____

Yes __ No __ N/A __ 2. Are project activities logbooks being kept up to date?

Comments: _____

_____

_____

Yes __ No __ N/A __ 3. Is each entry in the project activities logbook identified by date and author, if made by persons not originally assigned to the book?

Comments: _____

_____

_____

Yes __ No __ N/A __ 4. Are entries legible, factual, and made in ink?

Comments: _____

_____

_____

Quality Control

ITEM	Yes/No/NA	Comments
Does the laboratory maintain a Quality Control Manual?		
Does the manual address the important elements of a QC program, including the following:		
a. Personnel?		
b. Facilities and equipment?		
c. Operation of instruments?		
d. Documentation of procedures?		
e. Procurement and inventory practices?		
f. Preventive maintenance?		
g. Reliability of data?		
h. Data validation?		
i. Feedback and corrective action?		
j. Instrument calibration?		
k. Recordkeeping?		
l. Internal audits?		
Is the Site-Specific Quality Assurance Project Plan (QAPP) (the technical portions of which should be included with the contract provisions) available to laboratory personnel?		
Are laboratory personnel familiar with the QC requirements of the QAPP?		

ITEM	Yes/No/NA	Comments
Are QC responsibilities and reporting relationships clearly defined?		
Have standard curves been adequately documented?		
Are laboratory standards traceable?		
Are quality control charts maintained for each routine analysis?		
Do QC records show corrective action when analytical results fail to meet QC criteria?		
Do supervisory personnel review the data and QC results? How promptly?		
Are data calculations checked by a second person?		
Are data calculations documented?		
Are recoveries of organic surrogates documented?		
Are limits of detection determined and reported properly?		
Are all data and records retained for the required amount of time?		
Are quality control data (e.g., standard curve, results of duplication and spikes) accessible for all analytical results?		
Do supervisory personnel understand and agree to the reporting requirements required by the Contract and the Site-Specific QAPP?		
Are outside standard QC samples (such as EPA samples) run at least twice a year on each routinely performed method to verify that the standards used, the method used, and the instrument used is within acceptable limits?		

Analysis Time Frame

ITEM	Yes/No/NA	Comments
Is the Laboratory familiar with the required time frame for reporting data?		
Are personnel familiar with holding times of various analysis parameters?		
Does laboratory have sufficient personnel and instrumentation to meet time requirements?		
Does laboratory have a written policy of what to do in case of instrument breakdown (such as backup instrumentation, etc.)?		

Reporting Procedures

ITEM	Yes/No/NA	Comments
Is a standard reporting format required?		
Will interim sampling and analysis results be reported to the client for review and comment?		
Is provision made for a project QA report to summarize all QC data?		
Is provision made for the submission of raw data and chromatograms if required?		

Yes __ No __ N/A __ 5. Are modifications to the project workplan noted in the project activities logbook or elsewhere?

Comments: _____

_____

_____

Yes __ No __ N/A __ 6. Is an inventory of serialized field documents (Sample I.D. Tags, Chain-of-Custody Records, etc.) in the document control inventory logbook?

Comments: _____

_____

_____

Yes __ No __ N/A __ 7. Does the Field Notebook contain adequate information about each sample including the Sample I.D. Tag number, date, location, and information necessary to reconstruct the sample?

Comments: _____

_____

_____

Yes __ No __ N/A __ 8. Are entries to the Field Notebook made in ink?

Comments: _____

_____

_____

Yes __ No __ N/A __ 9. Are corrections properly executed with one line through the error in all project logbooks and Field Notebooks?

Comments: _____

_____

_____

Yes __ No __ N/A __ 10. Are all project notebooks and logbooks properly labeled with the project number, site number/ designation, and title?

Comments: _____

_____

_____

DOCUMENT AUDIT CHECKLIST

Document Control Officer

OFFICE LOCATION _____

DATE OF AUDIT _____

SIGNATURE OF AUDITOR _____

Yes __ No __ N/A __ 1. Is an inventory of serialized field documents (Sample I.D. Tags, Chain-of-Custody Records, Receipt-for-Samples Form, etc.) in the document control inventory logbook?

Comments: _____

Yes __ No __ N/A __ 2. Are project materials secured during other than working hours unless they are in use?

Comments: _____

Yes __ No __ N/A __ 3. Is Enforcement Sensitive material maintained in a secured area with a check-out log at all times?

Comments: _____

Attachment 2

LABORATORY EVALUATION CHECKLIST

Ecology and Environment, Inc., (E & E)

Laboratory Evaluation Checksheet

Laboratory: _____

Address _____

Date _____

Contract Number: _____

Contract Title: _____

Personnel Contacted:

Name	**Title**

Laboratory Evaluation Team:

Name	**Title**

ORGANIZATION AND PERSONNEL

ITEM	Yes/No/NA	Comments

Laboratory or Project Manager (individual responsible for overall technical effort):

Name: _____

Plasma Emission Spectroscopist

Name _____
Experience: 1 year minimum requirement

Flameless Atomic Absorption Spectroscopist

Name _____
Experience: 1 year minimum requirement

Inorganic Sample Preparation Expert

Name _____
Experience: 1 year minimum requirement

Flame and Cold Vapor AA Spectroscopist

Name: _____
Experience: 1 year minimum requirement

Classical Inorganic Techniques Analyst:

Name: _____
Experience: 1 year minimum requirement

Requirements for experience as listed are minimal and may be increased for specific projects involving difficult samples or unusual matrices.

ITEM	Yes/No/NA	Comments
GC/MS Operator: Name: _____ Experience: 1 year minimum requirement		
GC/MS Spectral Interpretation Expert: Name: _____ Experience: 3 years minimum requirement		
Purge and Trap Expert: Name: _____ Experience: 1 year minimum requirement		
Extraction Concentration Expert: Name: _____ Experience: 1 year minimum requirement		
Gas chromatography and/or Pesticide Residue Analysis Expert: Name: _____ Experience: 2 years minimum requirement		
Do the personnel assigned to this project have appropriate educational background to successfully accomplish the objectives of this project?		

ITEM	Yes/No/NA	Comments
Do personnel assigned to this project have the appropriate level and type of experience to successfully accomplish the objectives of this program?		
Is the organization adequately staffed to meet project commitments in a timely manner?		
Does the laboratory Quality Assurance supervisor report to senior management levels?		
Was the Project Manager available during the evaluation?		
Was the Quality Assurance supervisor available during the evaluation?		
Does the laboratory have a Quality Assurance Officer?		

Sampling

ITEM	Yes/No/NA	Comments
Do sampling procedures follow contract specifications?		
Is a unique identification on each sample?		
Is sampling information properly recorded such as sample type, sampling location, date and time of collection and name of sample collector?		
Are written chain-of-custody procedures available for review? Are they in accordance with E & E/EPA guidelines?		
Are tamper-proof seals used on samples that are shipped?		
Are Department of Transportation regulations in effect for samples that are shipped?		
Are proper sample containers being used as specified in E & E sample handling protocol?		
Are proper preservation techniques being used for the analytical methods and sample types concerned?		
Are provisions made for the collection of QA split samples?		
Are provisions made for field blanks and duplicate samples at an appropriate percentage (normally 10% each minimum or 1 each per set, whichever is greater, or as specified in contract?		
Is waste to be bulked prior to off-site disposal?		
Are adequate facilities available to do compatibility testing?		

GENERAL FACILITIES-Sample Receipt, Storage, and Preparation Areas

When touring the facilities, give special attention to: (a) the overall appearance of organization and neatness, (b) the proper maintenance of facilities and instrumentation, (c) the general adequacy of the facilities to accomplish the work.

ITEM	Yes/No/NA	Comments
Is a sample custodian designated for chain-of-custody samples? If yes, name of sample custodian. Name: _____		
Are written Standard Operating Procedures (SOP's) developed for receipt and storage of samples? Is a permanent logbook maintained with all pertinent sample information?		
Is the appropriate portion of the SOP available to the analyst at the sample receipt/storage area?		
Are chain-of-custody seals checked for integrity?		
Are the sample shipping containers opened in a manner to avoid possible laboratory contamination?		
Are samples that require preservation stored in such a way as to maintain their preservation?		
Are volatile samples stored separately from semi-volatile samples?		
Are adequate facilities provided for storage of samples, including cold storage?		
Is a system in effect which assures that the cold storage temperature is maintained?		
Are temperature excursions noted and are appropriate actions taken when required?		

ITEM	Yes/No/NA	Comments
Is the laboratory maintained in a clean and organized manner?		
Does the laboratory appear to have adequate work-space (120 sq feet, 6 linear feet of unencumbered bench space per analyst)?		
Are special facilities provided for handling extremely toxic materials such as dioxin (e.g., glove box, controlled air)?		
Are contamination-free work areas provided for trace level analytical work?		
Are exhaust hoods provided to allow contamination-free work with volatile and hazardous materials?		
Is the air flow of the hoods periodically checked and recorded?		
Are chemical waste disposal policies/procedures well-defined and followed by the laboratory?		
Is de-ionized water available for preparation of standards and blanks (both for Inorganics and Organics)?		
Are periodic safety briefings or lectures given?		
Are periodic QA/QC or general meetings held at regular intervals?		
Does the laboratory have adequate safety devices (eye wash stations, spill control stations, showers, first-aid stations, etc.)		
Are proper glassware cleaning procedures appropriate to analyses followed?		

ITEM	Yes/No/NA	Comments
Is the analytical balance located away from draft and areas subject to rapid temperature change?		
Has the balance been calibrated and checked within one year by a certified technician?		
Is the balance routinely checked with appropriate class S weights before each use and are the results recorded in a logbook?		
Is adequate chemical storage space available and are chemicals properly segregated according to class?		
Are solvent storage cabinets properly vented as appropriate for the prevention of possible laboratory contamination?		
Are reagent grade or higher purity chemicals used to prepare standards?		
Are analytical reagents dated upon receipt?		
Are reagent inventories maintained on a first-in, first-out basis?		
Are analytical reagents checked out before use?		
Are fresh analytical standards prepared at a frequency consistent with procedure requirements?		
Are reference materials properly labeled with concentrations, date of preparation, and the identity of the person preparing the sample?		

ITEM	Yes/No/NA	Comments
Is a logbook maintained to keep track of the preparation of spiking/calibration standards?		
Are the primary standards traceable to NBS or EPA standards?		
Do the analysts record bench data in a neat and accurate manner?		
Does the supervisor periodically examine and review the logbooks, notebooks and bench sheets?		
Are standards stored separately from sample extracts?		
Are volatile and semi-volatile solutions properly segregated?		
Is the appropriate portion of the SOP or procedures manual available to the analyst at the sample preparation area?		
Is the SOP for glassware washing posted at the cleaning station?		

INSTRUMENTATION

List the major laboratory instruments that will be used. Complete and instrument evaluation form on each one. (Note manufacturer, model, year of purchase, detectors, columns or other accessories should be listed.)

Instrument	Analysis

Instrument Evaluation Form

Instrument: _____

Instrument Mfg. _____

Model: _____ Year of Acquisition: _____

Condition: _____

Calibration Frequency: _____

Service Maintenance Frequency: _____

Other Pertinent Information: _____

ITEM	YES	NO	COMMENT
Are manufacturer's operating manuals readily available to the operator?			
Is there a calibration protocol available to the operator?			
Are calibration results kept in a permanent record? (permanent log book listing calibrations, instrument problems, etc. should be kept by each instrument.)			
Is a permanent service record maintained?			
Has the instrument been modified in any way?			
Is the instrument properly vented?			

SATISFACTORY? ☐ ☐

Comments: _____

Analytical Methodology

ANALYTE	REFERENCE	SPECIFIED IN CONTRACT	
		YES	NO

ITEM	Yes/No/NA	Comments
Are the required methods used?		
Is there any unauthorized deviation from contract methodology?		
Are written analytical procedures provided to the analyst?		
Are reagent grade or higher purity chemicals used to prepare standards?		
Are fresh analytical standards prepared at a frequency consistent with good QA?		
Are reference materials properly labeled with concentrations, date of preparation, and the identity of the person preparing the sample?		
Is a standards preparation and tracking logbook maintained?		
Do the analysts record bench data in a neat and accurate manner?		
Is the appropriate instrumentation used in accordance with the required protocol(s)?		

Quality Control

ITEM	Yes/No/NA	Comments
Does the laboratory maintain a Quality Control Manual?		
Does the manual address the important elements of a QC program, including the following:		
a. Personnel?		
b. Facilities and equipment?		
c. Operation of instruments?		
d. Documentation of procedures?		
e. Procurement and inventory practices?		
f. Preventive maintenance?		
g. Reliability of data?		
h. Data validation?		
i. Feedback and corrective action?		
j. Instrument calibration?		
k. Recordkeeping?		
l. Internal audits?		
Is the Site-Specific Quality Assurance Project Plan (QAPP) (the technical portions of which should be included with the contract provisions) available to laboratory personnel?		
Are laboratory personnel familiar with the QC requirements of the QAPP?		

ITEM	Yes/No/NA	Comments
Are QC responsibilities and reporting relationships clearly defined?		
Have standard curves been adequately documented?		
Are laboratory standards traceable?		
Are quality control charts maintained for each routine analysis?		
Do QC records show corrective action when analytical results fail to meet QC criteria?		
Do supervisory personnel review the data and QC results? How promptly?		
Are data calculations checked by a second person?		
Are data calculations documented?		
Are recoveries of organic surrogates documented?		
Are limits of detection determined and reported properly?		
Are all data and records retained for the required amount of time?		
Are quality control data (e.g., standard curve, results of duplication and spikes) accessible for all analytical results?		
Do supervisory personnel understand and agree to the reporting requirements required by the Contract and the Site-Specific QAPP?		
Are outside standard QC samples (such as EPA samples) run at least twice a year on each routinely performed method to verify that the standards used, the method used, and the instrument used is within acceptable limits?		

Analysis Time Frame

ITEM	Yes/No/NA	Comments
Is the Laboratory familiar with the required time frame for reporting data?		
Are personnel familiar with holding times of various analysis parameters?		
Does laboratory have sufficient personnel and instrumentation to meet time requirements?		
Does laboratory have a written policy of what to do in case of instrument breakdown (such as backup instrumentation, etc.)?		

Reporting Procedures

ITEM	Yes/No/NA	Comments
Is a standard reporting format required?		
Will interim sampling and analysis results be reported to the client for review and comment?		
Is provision made for a project QA report to summarize all QC data?		
Is provision made for the submission of raw data and chromatograms if required?		

QAPP
Comments

Sanget
Superfund/Tech.

ecology and environment, inc.

111 WEST JACKSON BLVD., CHICAGO, ILLINOIS 60604, TEL. 312-663-9415

International Specialists in the Environment

October 17, 1986

Mr. Jeff Larson
Illinois EPA
Division of Land Pollution Control
2200 Churchill Road
Springfield, Illinois 62706

Dear Jeff:

Per our telephone conversation on October 16, 1986, this letter will serve as a formal modification to the Quality Assurance Project Plan (QAPP) for the Dead Creek Project.

IEPAs comments on the revised QAPP (May 1986) were outlined in a memorandum from Ron Turpin dated July 25, 1986. The revised QAPP refers to a document entitled "E & Es Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, April 1986." IEPAs Quality Assurance Officer expressed the need to review this manual prior to approving the QAPP.

A September 1986 revision of E & Es QA/QC manual was sent to you on October 15, 1986 for submittal to the IEPA Quality Assurance Officer. This revision will be used by E & E personnel for the Dead Creek Project. In view of this, wherever the April 1986 issue of E & Es manual is referred to in the QAPP, it should be changed to read September 1986. Specific page numbers in the QAPP where this change will be necessary are as follows: 5-12, 5-13, 5-14, 6-1, 6-7, and 8-13. Handwritten changes have been made to E &Es copies of the QAPP, and the applicable pages are enclosed for your file.

Please contact me should you have any questions regarding this matter.

Sincerely

Dan Sewall

Dan Sewall

39E1F

RECEIVED
OCT 22 1986
IEPA-DLPC

5.8 SAMPLE CONTAINERS

The volumes and containers required for the sampling activities are included in Tables 5-1 and 5-2. Pre-washed sample containers will be provided by E & E's ASC and prepared in accordance with USEPA bottle washing procedures. These procedures are incorporated in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, ~~April~~ SEPTEMBER 1986.

Table 5-1

SAMPLE CONTAINERS, VOLUMES, PRESERVATION,
AND HOLDING TIMES FOR WATER SAMPLES

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per Sample)	Preservation	Maximum Holding Time
Purgeable (Volatile) Organics	40-ml glass vial with Teflon-backed septum	Two (2); fill completely, no air space	Cool to 4°C (ice in cooler)	7 days
Extractable Organics, PCBs, Pesticides	1/2-gallon bottles with Teflon-lined caps	Two (2); total volume approx. 1 gallon; fill completely	Cool to 4°C (ice in cooler)	Must be extracted within 5 days; analyzed within 30 days
Metals	1-liter polyethylene bottle with polyethylene-lined caps	One (1); fill 7/8 full	Nitric acid to below pH 2 (approx. 1.5 ml Con HNO_3 per liter)	6 months
Cyanides	1-liter polyethylene bottle with polyethylene-lined caps	One (1); fill completely	Sodium hydroxide to pH 12 and cool to 4°C (ice in cooler)	24 hours, if sulfide present; 14 days

Note: All sample bottles will be prepared in accordance with USEPA bottle washing procedures. These procedures are incorporated in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, ~~April~~ SEPTEMBER 1986.

Table 5-2

SAMPLE CONTAINERS, VOLUMES, PRESERVATION,
AND HOLDING TIMES FOR SOIL SAMPLES

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per Sample)	Preservation	Maximum Holding Time
Purgeable (Volatile) Organics	40-ml glass vial with Teflon-backed septum	Two (2); fill completely, no air space	Cool to 4°C (ice in cooler)	10 days
Extractable Organics, PCBs, Pesticides	8-oz. glass jar with Teflon-lined cap	One (1); fill completely	Cool to 4°C (ice in cooler).	Must be extracted within 10 days; analyzed within 30 days
Metals	8-oz. glass jar with Teflon-lined cap	One (1); fill half-full	Cool to 4°C (ice in cooler)	6 months
Cyanides	8-oz. glass jar with Teflon-lined cap	One (1); fill completely	Cool to 4°C (ice in cooler)	24 hours, if sulfide present;
2,3,7,8 TCDD	8-oz. glass jar with Teflon-lined cap	One (1); fill completely	Cool to 4°C (ice in cooler)	Must be extracted within 5 days; analyzed within 30 days

Note: All sample bottles will be prepared in accordance with USEPA bottle washing procedures. These procedures are incorporated in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, ~~April~~ SEPTEMBER 1986.

6. SAMPLE CUSTODY

6.1 STANDARD OPERATING PROCEDURES

This section describes standard operating procedures for sample identification and chain-of-custody. The purpose of these procedures is to ensure that the quality of the samples is maintained during their collection, transportation, and storage through analysis. All chain-of-custody requirements comply with standard operating procedures indicated in USEPA sample handling protocol. All sample control and chain-of-custody procedures applicable to the E & E ASC are presented in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, ~~April~~ September 1986.

Sample identification documents must be carefully prepared so that sample identification and chain-of-custody can be maintained and sample disposition controlled. Sample identification documents include:

- Field notebooks;
- Sample label;
- Custody seals; and
- Chain-of-custody records.

6.1.1 Chain-of-Custody

The primary objective of the chain-of-custody procedures is to provide an accurate written record that can be used to trace the

- Photographer (signature),
- Weather conditions,
- Description of photograph taken,
- Reasons why photograph was taken,
- Sequential number of the photograph and the film roll number, and
- Camera lens system used.

After the photographs have been developed, the information recorded in the field notebook should be transferred to the back of the photographs.

6.1.3 Sample Handling, Packaging, and Shipping

The transportation and handling of samples must be accomplished in a manner that not only protects the integrity of the sample but also prevents any detrimental effects due to the possible hazardous nature of samples. Regulations for packaging, marking, labeling, and shipping hazardous materials are promulgated by the United States Department of Transportation (DOT) in the Code of Federal Regulations, 49 CFR 171 through 177.

All chain-of-custody requirements must comply with standard operating procedures in the USEPA sample handling protocol. All sample control and chain-of-custody procedures applicable to the E & E Analytical Services Center (ASC) are presented in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, ~~April~~ SEPTEMBER 1986.

Sample Packaging

Samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. The following sample packaging requirements will be followed:

Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, ~~April~~ SEPTEMBER 1986.

IL 3020 D1180

APPENDIX C

HEALTH AND SAFETY PLAN
DEAD CREEK PROJECT

September 1986

Prepared for:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

ecology and environment, inc.
195 SUGG ROAD, P.O. BOX D, BUFFALO, NEW YORK 14225, TEL. 716-632-4491
International Specialists in the Environment

ecology and environment, inc.

HAZARDOUS AND TOXIC MATERIALS TEAM
SITE SAFETY PLAN

A. GENERAL INFORMATION

SITE: Dead Creek Project Job No.: IL-3020

LOCATION: Sauget and Cahokia, Illinois

PLAN PREPARED BY: Dan Sewall DATE: 9/22/86

APPROVED BY: Paul O. Mora DATE: 10-1-86

OBJECTIVE(S): Monitoring Well Installation, Surface and Subsurface Soil Sampling, Surface and Groundwater Sampling, Soil-Gas Survey.

PROPOSED DATE OF INVESTIGATION: October 1986 - March 1987

BACKGROUND REVIEW: Complete: ____ Preliminary: X

DOCUMENTATION/SUMMARY: Overall Hazard: Serious: X Moderate: ____

Low: ____ Unknown: ____

B. SITE/WASTE CHARACTERISTICS

WASTE TYPE(S): Liquid X Solid X Sludge X Gas ____

Corrosive X Ignitable X Radioactive ____ Volatile X

Toxic X Reactive X Unknown X Other (Name) teratogenic; carcinogenic, mutagenic, persistent

FACILITY DESCRIPTION: The study area consists of 18 sites (370 acres) including: manufacturing facilities, inactive landfills, surface impoundments, and Dead Creek.

Principal Disposal Method (type and location): Landfill (area filling), waste piles, surface impoundments, open dumping.

Unusual Features (dike integrity, power lines, terrain, etc.): Power lines traverse the entire area west of Rte 50. A flood control levee is located immediately east of Site Q - see map.

Status: (active, inactive, unknown) Inactive, other than manufacturing facilities.

History: (injuries; complaints; previous agency action): Illinois EPA has received several complaints dating back to the early 1970's concerning dumping in Dead Creek. A fence was constructed around the creek and Site M from Judith Ln. to Queeny Ave. as a result of a preliminary study done by IEPA in this area. The Illinois Pollution Control Board and the Attorney General's Office have been involved in actions concerning Sites Q and R.

C. HAZARD EVALUATION
(Use Supplemental Sheets if Necessary)

Summary (attach copy of available chemical information from Sax, Merck Index, Chemtods, etc.): The following is a brief list of contaminants found at various sites in the study area during past agency and contractor investigations. This list is by no means a complete compilation of all contaminants found or suspected, and is provided simply as an indication of the types of contaminants which may be encountered during field activities.

2,3,7,8-TCDD (Dioxin)
PCB's (Not specified)
o-Dichlorobenzene
Dichlorophenol
Lead
Cadmium
Arsenic
Chlorotoluene
Phosphorus (not specified)
Pentachlorophenol
Vinyl chloride
Phosgene
Mercury
See attached hazard evaluation sheets for specific information.

D. SITE SAFETY WORK PLAN

PERIMETER ESTABLISHMENT: Map/Sketch Attached? Yes Site Secured? A

Perimeter Identified? Yes Zone(s) of Contamination Identified? B

A. Secured sites include: Dead Creek (Queeny to Judith); Sites I, M, N, R.

B. Zones preliminarily identified - investigation incomplete. Assume entire area to to be contaminated.

PERSONAL PROTECTION:

Level of Protection: A ____ B X C X D X

Modifications: MINIMUM protective clothing will include: neoprene boots (steel toe and shank), hooded Tyvek or Saranex coveralls, neoprene gloves, disposable latex booties, disposable latex gloves, hard hats. See attachment for task-specific levels of protection.

Surveillance Equipment and Materials: All field activities will include monitoring with an Hnu (10.2 lamp) or OVA, rad-mini, and cyanide meter or monitox, and an explosimeter/O_2 meter, GCA/MDA real time particulate meter. Optional: MDA/GCA dust monitor will be used if conditions warrant.

PERSONAL PROTECTION (Cont.):

Action Levels:

OVA/Hnu - 0 ppm above background - Level D

1 - 5 ppm above background - Level C

6 - 500 ppm above background - Level B - Contact Regional Safety Coordinator (RSC) prior to upgrade.

>501 ppm above background - Level A

O_2 Meter - <19.5% - Level B, contact RSC.

>25% - Leave area, contact RSC.

Explosimeter - <20% LEL - Continue operation.

20-30% LEL - Identify source, initiate vapor suppressional measures

>30% LEL - Leave area

Particulate Monitor - >2 mg/m^3 - Initiate dust suppression measures

Monitox CN Monitor - >5 mg/m^3 - Level A, contact RSC.

Rad-mini - Any readings - depart site and contact RSC.

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PERSONAL PROTECTION

The purpose of this attachment is to outline the anticipated levels of protection for each of the objectives in the field investigation phase of this project. Upgrading and downgrading of these levels will be determined in the field based on our readings, weather conditions, and professional judgement. Minimum protective clothing to be worn by any task will include: neoprene boots (steel toe and shank), tyvek or saranax coveralls, disposable gloves and booties, hard hats, and neoprene gloves.

Subsurface Soil Sampling/Well Installation

The present scope of work includes collecting subsurface soil samples at sites G, H, I, J, K, L, and N. Well installation is scheduled for sites G, H, I, O, and Q.

The anticipated level of protection for collection of subsurface samples at sites G, H, I, and L is Level C. This will include racal power air-purifying respirators (APRs) in addition to the protective clothing listed above. It is expected that subsurface sampling at sites J, K, and N will be conducted in Level D. Monitoring with all equipment specified in the safety plan will take place during all drilling activities, and upgrades or downgrades in personal safety measures will be made as necessary. Hearing protection will be worn by personnel working on or near operating drill rig. It is anticipated that drilling and well installation at site Q will be conducted in modified Level B protection. This will include the minimum protective clothing (saranac coveralls) along with self-contained air.

Air will be supplied by a cascade system of air cylinders and run through a manifold system to separate air lines for each team member at the drill rig. The air cylinders will be located on a support vehicle near the drill rig. Drilling and well installation at the remaining sites will initially be conducted in Level C protection.

All levels of protection are based on existing background information. Upgrading and downgrading of these levels will be done in the field using best professional judgement, along with real-time instrumentation readings.

Surface Water/Sediment Sampling

Surface water samples will be collected from creek sectors A-D and Site M using a Kemmerer sampler or by dipping a wide-mouthed glass jar and collecting a grab sample. The anticipated level of protection for all surface water sampling is Level C, which will include racal power APRs along with the minimum protective clothing listed above. Viton or neoprene gloves, taped at the wrist, will also be worn.

Sediment samples will be collected from creek sectors A-D and Site M using a peterson dredge or similar sampling device. The anticipated level of protection is as outlined above for surface water sampling. The need for upgrades or downgrades will be determined in the field using best professional judgement, along with real-time instrumentation readings.

Surface Soil Sampling

Surface soil samples will be collected from sites G and J. Level C protection is anticipated to be sufficient for surface soil sampling at both sites. Racal power APRs will be worn in addition to the minimum protective clothing noted above. Upgrades will be determined in the field using best professional judgement, along with real-time instrumentation readings.

Groundwater Sampling

Groundwater samples will be collected from new monitoring wells at sites G, H, I, O, and Q; from existing monitoring wells in the vicinity of sites G, H, and L; and from residential wells to be determined.

Sampling of all monitoring wells is anticipated to be conducted in Level C protection. This will include racal power APRs and viton or neoprene gloves in addition to the minimum protective clothing. Residential well samples will be collected from existing plumbing in Level D protection. Upgrading and downgrading of these levels will be determined in the field as necessary, and downgrading will be cleared through the safety coordinator.

Soil Gas Monitoring/Air Investigation

Soil gas monitoring will be conducted at sites G, H, I, J, K, L, M, and N in addition to all creek sectors. The soil gas survey will consist of pounding a small diameter well point into the ground with a special cylindrical hammer, followed by pumping air from the well point into collection bags. Analysis of samples will then be completed using an OVA.

It is anticipated that all soil gas monitoring will be conducted in Level C protection, including racal power APRs in addition to the minimum protective clothing.

The air investigation will consist of surveying all sites to identify potential point sources. This will be followed by more detailed sampling of any "hot spots" encountered. All air investigations done in off-site areas are expected to be conducted in Level A protection as above, with upgrades to be determined in the field. On-site air investigations will be conducted in conjunction with other field activities (surface and subsurface soil sampling), and the level of protection will be as outlined above for these activities.

SPECIAL SITE CONSIDERATIONS: See attachment.

DECONTAMINATION PROCEDURES:

Personal: Disposable protective clothing will be bagged, labeled, and drummed. Boot and glove wash with TSP and water. Formal hot line set up necessary.

Equipment: TSP & water wash with rinse as necessary. Sampling equipment: TSP-water wash followed by solvent rinse (acetone-hexane-acetone)/DI water rinse. All drilling equipment (augers, split spoons...) to be steam-cleaned. Air lines will be decontaminated in the following manner: internal - lines will be purged with Grade D or E quality air; external - TSP-water wash and rinse, as necessary.

INVESTIGATION - DERIVED MATERIAL DISPOSAL: (Note - If material is proposed to be left on site, written authorization is to be received by the Project Team Leader prior to the initiation of on site activities): Drill cuttings, purge water will be containerized and moved inside Dead Creek fence. Other disposables will be bagged, labeled, and containerized prior to moving inside Dead Creek fence.

SITE ENTRY PROCEDURES: Decontamination station will be determined each day based on weather conditions. Entry procedures will include ambient air monitoring with surveillance equipment.

Team Member	Responsibility
Dan Sewall	Team Leader
*	Safety Officer TBA
*	TBA
*	TBA
Drillers/subcontractor personnel	

*Additional members to be determined. Project log book will include team members and dates present for all field activities. All subcontractor personnel are to provide SSC with written certification of medical approval, training status, and ability to wear specified respiratory equipment.

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SPECIAL SITE CONSIDERATIONS

Prior to initiating drilling local utilities will be contacted to define subsurface transmission lines. Maneuverability is limited in Dead Creek area north of Judith Lane. Care should be taken to minimize stressful conditions resulting from extreme temperatures. Heat stress/cold stress symptoms will be monitored and recorded in the SSC's log book. Work will be conducted during daylight hours only.

E. EMERGENCY INFORMATION

(Use Supplemental Sheets if Necessary).

EMERGENCY PRECAUTIONS

Acute Exposure Symptoms	First Aid
Chlorotoluene: Severe irritation of skin and respiratory system	Wash irritated areas with water; get medical aid
Pentachlorophenol: Dust and vapors irritate skin and mucous membranes - severe coughing and sneezing	Ingestion: Immediately induce vomiting Dermal: Wash affected areas with soap and water
PCB's: Rash and acne from dermal contact	Ingestion: Provide water, induce vomitting
2,3,7,8-TCDD: Acne, skin and eye irritation, respiratory distress	Dermal: Soap and water wash

*See attached hazard evaluation sheets for additional information.

LOCAL RESOURCES
(Name, Address and Phone Number)
LOCAL AREA CODE: 618

Ambulance 332-6600 Sauget Fire Dept.

Hospital Emergency Room 874-7076 Christian Welfare Hospital

Poison Control Center 1-800-252-2022 St. John's Hospital - Springfield

Police (incl. Local, County Sheriff, State) 332-6500 (Sauget), 1-277-3500 (County), 345-1212 (State)

Fire Department 332-6600

Airport 337-6060 Bi-State Parks Airport, Cahokia

Explosives Unit 345-1212 - State Police

Agency Contact (EPA, State, Local, USCG, etc.) 217/782-6760 - Jeff Larsen - IEPA

Local Laboratory 235-1780 - St. Clair Medical Laboratory

Federal Express 314/367-8278; 6181 Aviation Dr., St. Louis Airport

Client Contact Jeff Larson, IEPA - Springfield 217/782-6760

Others IEPA Emergency Response Unit - 217/782-3637

Emergency Services and Disaster Agency - 217/782-7860

SITE RESOURCES

Water Supply 5 gallon collapsible containers will be used.

Telephone Falling Springs Rd. and Queeny Ave.; Rte. 3 and Monsanto Ave.

Radio To be determined.

Other —

7/84 Revised OLD

Emergency Contacts

1. Mr. Raymond Harbison (University of Arkansas) ..... (501) 661-5766 or 661-5767
   (501) 370-8263 (24 hour)

2. Paul D. Moss, Regional Safety Coordinator/Chicago ..... (312) 663-9415 (office)
   (312) 541-6635 (home)

3. Ecology and Environment, Inc., Corporate Safety Director/
   Paul Jonmaire ..... (716) 632-4491 (office)
   (716) 631-9530 (Emergency off-Hours)

Medtox Hotline

1. Twenty-four hour answering service - (501) 370-8263

   What to Report:

   - State: "This is an emergency."
   - Your name, region, and site.
   - Telephone number to reach you.
   - Your location.
   - Name of person injured or exposed.
   - Nature of emergency.
   - Action taken.

2. One of three toxicologists (Drs. Raymond Harbison, Glenn Milner, or Robert James) will contact you. Repeat the information given to the answering service.

3. If a toxicologist does not return your call within 15 minutes, call the following persons in order until contact is made:

   E & E Corporate Headquarters (EST 0830-1700) - (716) 632-4491

   a. Twenty-four hour line - (716) 631-9530

   b. Corporate Safety Director - David Dahlstrom (home - (716) 741-2384)

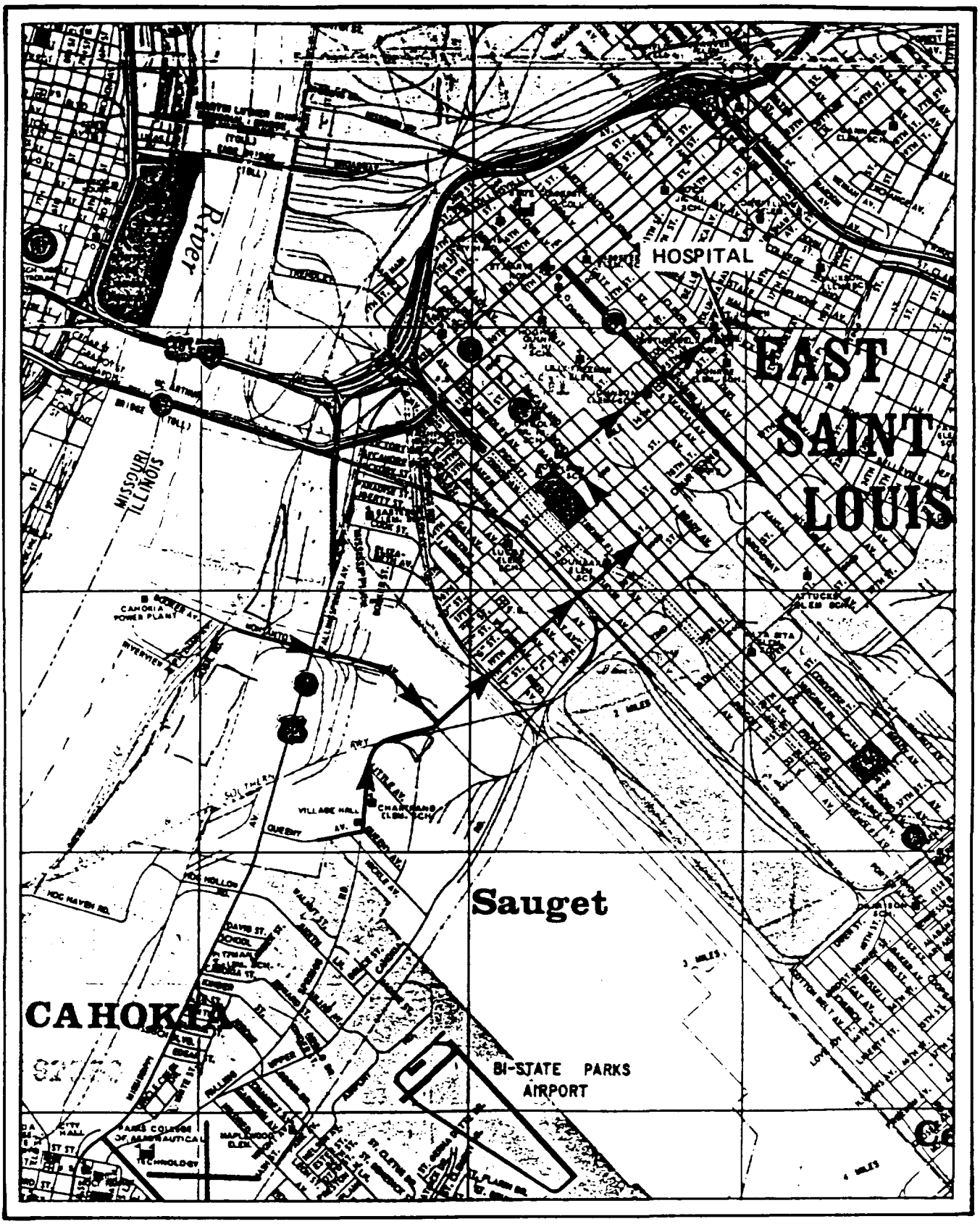
   c. Assistant Corporate Safety Officer - Steve Sherman (home - (716) 688-0084)

Emergency Routes

Directions to Hospital (incl. MAP) Monsanto Ave. east to Monsanto Rd. (19th St. in E. St. Louis) north on 19th St. to Bond Ave., West on Bond Ave. to 15th St., North on 15th St. to King Drive. East on King Dr. to Christian Welfare Hospital. Routes to be driven by designated site personnel prior to initiating on-site operations.

Other To BI State Parks Airport: State Route 50 south to Judith Lane. East on Judith Lane to Cahokia Rd., South on Cahokia Rd. to Julian Ave., East on Julian Ave. to Airport Rd.

7/84 Revised DLD



HOSPITAL ROUTES

F. EQUIPMENT CHECKLIST

PROTECTIVE GEAR

LEVEL A	
SCBA	___
SPARE AIR TANKS	___
ENCAPSULATED SUIT (FOR EMERGENCY)	X
SURGICAL GLOVES	___
NEOPRENE SAFETY BOOTS	___
BOOTIES	___
GLOVES (TYPE_____)	___
OUTER WORK GLOVES	___
HARD HAT	___
CASCADE SYSTEM	___
_____	___
_____	___
_____	___
_____	___

LEVEL B	
SCBA	X
SPARE AIR TANKS	X
CHEMICAL RESISTANT COVERALLS	X
PROTECTIVE COVERALL (TYPE SARANAC (HOODED))	X
RAIN SUIT	X
BUTYL APRON	___
SURGICAL GLOVES	X
GLOVES (TYPE VITON)	X
OUTER WORK GLOVES	___
NEOPRENE SAFETY BOOTS	X
BOOTIES	X
HARD HAT WITH FACE SHIELD	X
CASCADE SYSTEM	___
MANIFOLD SYSTEM	X
AIR COMPRESSOR	X

LEVEL C	
ULTRA-TWIN RESPIRATOR	X
RACAL POWER AIR PURIFYING RESPIRATOR	X
RACAL CARTRIDGES (TYPE GMC-H AEP-3) HEPA FILTERS	X
ROBERTSHAW ESCAPE MASK	___
CHEMICAL RESISTANT COVERALLS	X
PROTECTIVE COVERALL (TYPE SARANAC (HOODED))	X
RAIN SUIT	X
BUTYL APRON	___
SURGICAL GLOVES (LATEX)	X
GLOVES (TYPE VITON - NEOPRENE)	X
OUTER WORK GLOVES	___
NEOPRENE SAFETY BOOTS	X
HARD HAT WITH FACE SHIELD	X
LATEX DISPOSABLE BOOTIES	X

LEVEL D	
ULTRA-TWIN RESPIRATOR (AVAILABLE)	X
CARTRIDGES (TYPE GMC-H, GM-P)	X
ROBERTSHAW ESCAPE MASK (AVAILABLE)	___
CHEMICAL RESISTANT COVERALLS	X
PROTECTIVE COVERALL (TYPE TYVEK, SARANAC)	X
RAIN SUIT	___
NEOPRENE SAFETY BOOTS	X
BOOTIES (LATEX)	X
WORK GLOVES	___
HARD HAT WITH FACE SHIELD	X
SAFETY GLASSES	X
_____	___
_____	___
_____	___

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INSTRUMENTATION		DECON EQUIPMENT (CONT.)	
OVA	X	PLASTIC SHEETING	X
THERMAL DESORBER		TARPS	X
O2/EXPLOSIMETER	X	TRASH BAGS	X
EXPLOSIMETER CALIBRATION KIT	X	TRASH CANS	
HNU W/10-2 EV LAMP	X	MASKING TAPE	X
RAD-MINI	X	DUCT TAPE	X
MAGNETOMETER	X	PAPER TOWELS	X
PIPE LOCATOR		FACE MASK	
WEATHER STATION	X	FACE MASK SANITIZER	X
DRAEGER PUMP		FOLDING CHAIRS	X
BRUNTON COMPASS		STEP LADDERS	
HNU CALIBRATION KIT	X		
MONITOX CN METER	X		
GCA/MDA PARTICULATE MONITOR	X		
FIRST AID EQUIPMENT		SAMPLING EQUIPMENT	
FIRST AID KIT	X		
OXYGEN ADMINISTRATOR		To be determined	
STRECHER	X		
PORTABLE EYE WASH	X		
BLOOD PRESSURE MONITOR	X		
RADIATION BADGES	X		
FIRE EXTINGUISHER	X		
THERMOMETERS (OVAL)	X		
WALKIE-TALKIE	X		
DECON EQUIPMENT			
WASH TUBS	X		
BUCKETS	X		
SCRUB BRUSHES	X		
PRESSURIZED SPRAYER	X		
DETERGENT (TYPE TSP)	X		
SOLVENT (TYPE HEXANE)	X		
ACETONE	X		

VAN EQUIPMENT		MISCELLANEOUS (CONT.)	
TOOL KIT	___	BINOCULARS	___
HYDRAULIC JACK	___	MEGAPHONE	___
LUG WRENCH	___	___	___
TOW CHAIN	___	___	___
VAN CHECK OUT	___	___	___
GAS	___	___	___
OIL	___	___	___
ANTIFREEZE	___	___	___
BATTERY	___	___	___
WINDSHIELD WASH	___	___	___
TIRE PRESSURE		___	___
___	___	___	___
___	___	___	___
___	___	___	___
		___	___
MISCELLANEOUS		___	___
PITCHER PUMP	___	___	___
SURVEYOR'S TAPE	X	___	___
100 FIBERGLASS TAPE	___	___	___
300 NYLON ROPE	___	___	___
NYLON STRING	___	___	___
SURVEYING FLAGS	___	___	___
FILM	X	___	___
WHEEL BARROW	___	___	___
BUNG WRENCH	___	___	___
SOIL AUGER	___	___	___
PICK	___	___	___
SHOVEL	___	___	___
CATALYTIC HEATER	___	___	___
PROPANE GAS	___	___	___
BANNER TAPE	X	___	___
SURVEYING METER STICK	___	___	___
CHAINING PINS & RING	___	___	___
TABLES	___	___	___
WEATHER RADIO	X	___	___

HAZARDOUS & TOXIC MATERIALS TEAM
SITE SAFETY REVIEW

GENERAL INFORMATION

DATE_____ TIME_____ JOB NO:_____

SITE: _____

LOCATION: _____

ONSITE CLIENT CONTACT: _____

OBJECTIVES: _____

TYPES OF CHEMICALS ANTICIPATED: _____

MEETING CONDUCTED BY: _____

TOPICS DISCUSSED

PHYSICAL HAZARDS: _____

CHEMICAL HAZARDS: _____

PERSONAL PROTECTION: _____

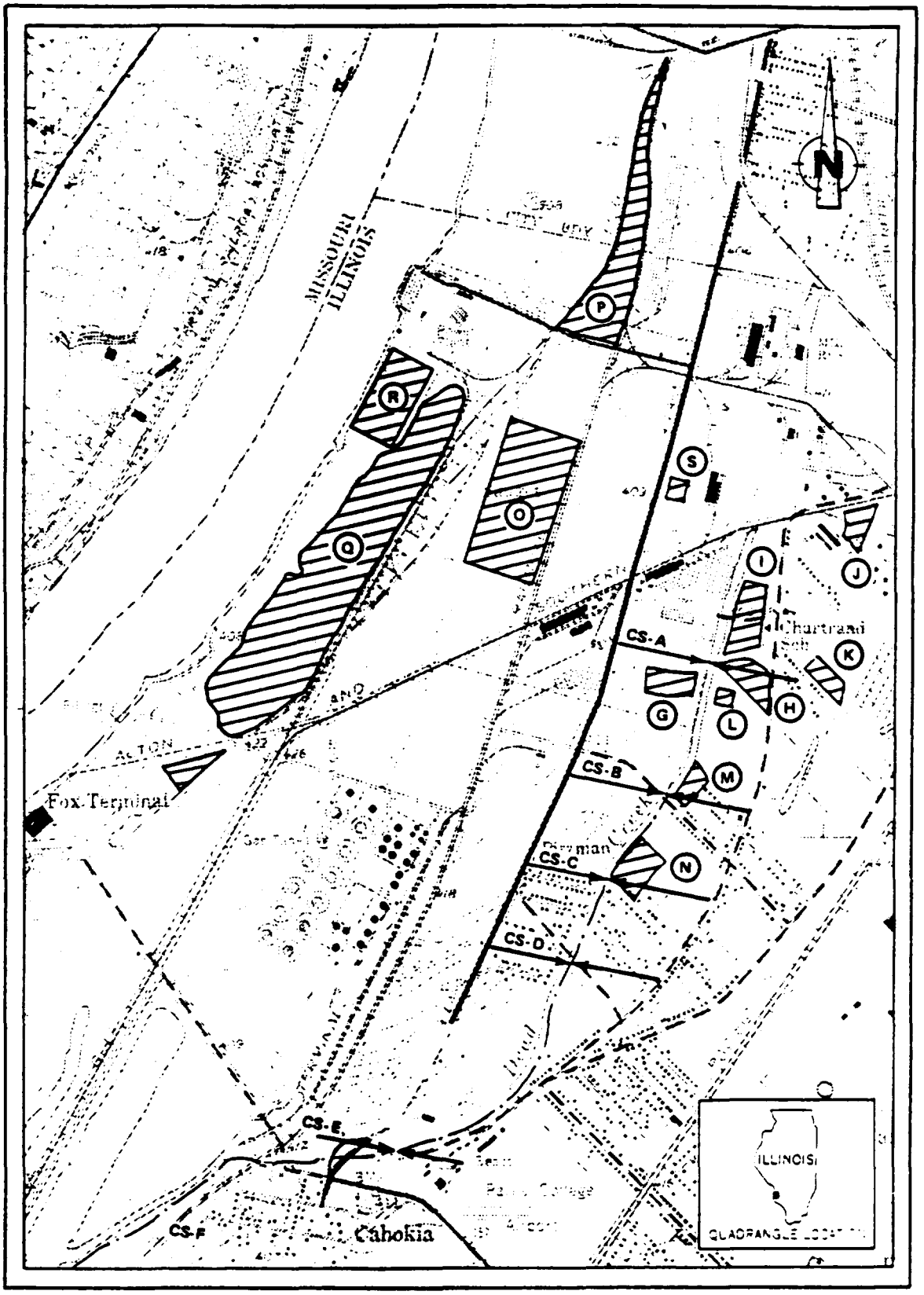
DECONTAMINATION: _____

SPECIAL SITE CONSIDERATIONS: _____

CHECK LIST

1. Emergency information reviewed? and made familiar to all team members?
2. Route to nearest hospital driven and its location known to all team?
3. Site safety plan readily available and its location known to all team members? ____

7/84 Revised DLD



DEAD CREEK PROJECT AREA SITE LOCATION MAP

(2) Should a sample be analyzed with too high a concentration of a single compound (i.e. acetone) to fall within the calibrated range, that compound will be flagged with an "E" indicating an estimated value. Illinois looked favorably on this but will reserve final decision until discussed with their people. They may be willing to pay for two analyses (the high and the on-scale) in order to obtain the additional information as well as meeting CLP requirements.

(3) No, surrogate recovery windows cannot be widened. Illinois EPA is willing to pay for re-analyses if surrogates fall outside required limits.

(4) In samples where large numbers of aliphatic hydrocarbons are present, they will be treated as a single TIC (Tentatively Identified Compound) labelled "Total Unknown Aliphatic Hydrocarbons" using m/e 57 for calculating concentrations against the response factor (m/e 57) for an oil standard. This allows for additional efforts to be made in determining if any other compounds of interest are present in the sample.

(5) Illinois EPA accepts that PCB retention time windows may shift during analysis. This is acceptable for multi-peak compounds, not for single-response pesticides.

(6) Whenever possible, draft reports of Dead Creek data will be issued to expedite getting information back to the users.

(7) Yes, IEPA requires data packs to be issued in the agreed upon format.

CW/db

copy Ron Turpin 9L

MEMORANDUM

TO: Andy Clifton

FROM: Caryn Wojtowicz

DATE: February 12, 1987

SUBJECT: Meeting with Illinois EPA January 30, 1987

CC: Gary Hahn, Barb Krajewski, File, Mike Miller

At your request, I have summarized our discussion with Illinois EPA (Ron Turpin, QA Officer and Jeff Larson, Project Manager), and E & E Project Manager, Mike Miller, that took place at E & E Chicago office on January 30, 1987.

The discussion centered on the analytical problems encountered in analyzing samples from Dead Creek. For the ease of summarizing the meeting, references will be made to the attached agenda.

(1) Sample handling can be minimized.

(a) Analyze 4-5 g of soil for VOA compounds unless >100 ppm OVA reading is reported. If >100, use 2 g or methanol extraction as required. It is extremely important to achieve as low a detection limit as possible in the suspected clean areas.

(b) 3 g of well-mixed soil will be extracted for semi-volatile, pesticide/PCB's analysis. Should little or no contamination be observed, the sample will be re-extracted at no cost to Illinois using 30 g of sample. This re-extraction, if required, is holding time exempt.

(c) Percent solids will no longer be required. However, to maintain a consistent data base for comparison, all samples already reported on a "dry weight basis" must be converted to "as received basis". Barb Krajewski will coordinate and re-issue corrected reports.

(d) pH no longer required.

January 30, 1987

E & E/IEPA Meeting, E & E Chicago Office

Points for discussion:

(1) Some soil samples are so highly contaminated with toxins that we would like to minimize sample handling.

(a) Routinely analyze 2 g or less for VOA compounds;
(b) Extract 3 g or less for semivolatile compounds;
(c) Eliminate determination of percent solids;
(d) Eliminate determination of soil pH.

(2) Most compounds detected in soil samples are not HSL analytes. If an HSL analyte is above the calibration limit, the sample has to be diluted, thus potentially losing valuable information (and QC data) for comparatively little gain in accuracy. Can we leave this to the judgment of the analyst and supervisor?

(3) Samples containing high concentrations of semivolatile organics often show only low levels of HSL volatile compounds. However, surrogate recoveries are often out of specification because of the high organic levels. Can we widen the VOA surrogate windows?

(4) Some soil samples show high concentrations of hydrocarbons, with a typical "envelope" chromatogram. Strict interpretation of the IFB requirements may result in a large amount of less than useful data; and perhaps loss of some important information. (For ~~example, we~~ have failed to identify and quantify octachlorodibenzodioxin through strict application of the rules). ~~Can we attempt to quantify~~ total hydrocarbons in the sample (against a RF generated from a crude oil analysis)? Again, would like to use analyst/supervisor judgment on this.

(5) Pesticide and PCB response factors and retention times do not always hold through the 12-hour analytical sequence. This has not been a problem with regular samples, and we attribute it to the highly contaminated nature of the Dead Creek samples. Would like to rely on analyst/supervisor judgment in identifying and quantifying "hits".

(6) It's taking a while to get the data packs out. Would a draft form data summary help? (Could be done quickly.)

(7) A typical data pack can contain more than 20 separate tune results (listing, mass spectrum, and Form V for each) and 20 or more separate daily calibrations. Do IEPA require all these data?

January 30, 1987

E & E/IEPA Meeting, E & E Chicago Office

Points for discussion:

(1) Some soil samples are so highly contaminated with toxins that we would like to minimize sample handling.

(a) Routinely analyze 2 g or less for VOA compounds;
(b) Extract 3 g or less for semivolatile compounds;
(c) Eliminate determination of percent solids;
(d) Eliminate determination of soil pH.

(2) Most compounds detected in soil samples are not HSL analytes. If an HSL analyte is above the calibration limit, the sample has to be diluted, thus potentially losing valuable information (and QC data) for comparatively little gain in accuracy. Can we leave this to the judgment of the analyst and supervisor?

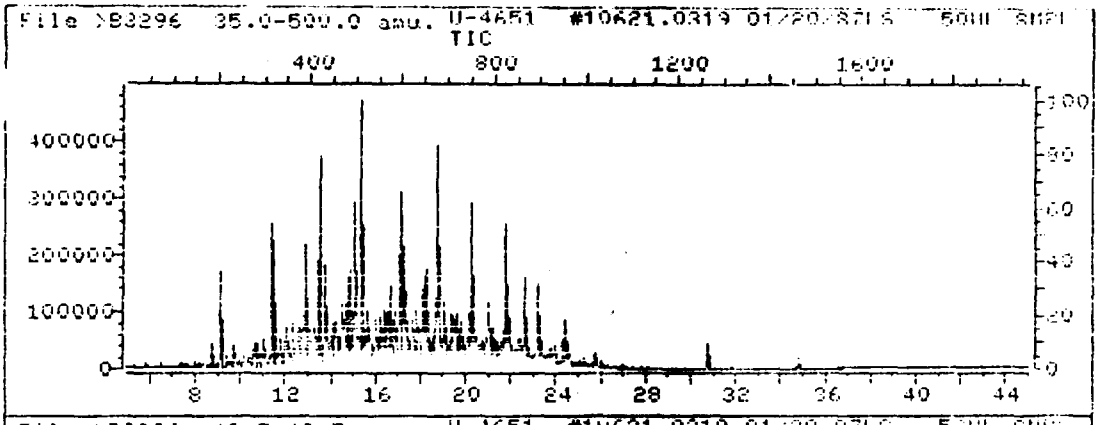
(3) Samples containing high concentrations of semivolatile organics often show only low levels of HSL volatile compounds. However, surrogate recoveries are often out of specification because of the high organic levels. Can we widen the VOA surrogate windows?

(4) Some soil samples show high concentrations of hydrocarbons, with a typical "envelope" chromatogram. Strict interpretation of the IFB requirements may result in a large amount of less than useful data; and perhaps loss of some important information. (For example, we have failed to identify and quantify octachlorodibenzodioxin through strict application of the rules). Can we attempt to quantify total hydrocarbons in the sample (against a RF generated from a crude oil analysis)? Again, would like to use analyst/supervisor judgment on this.

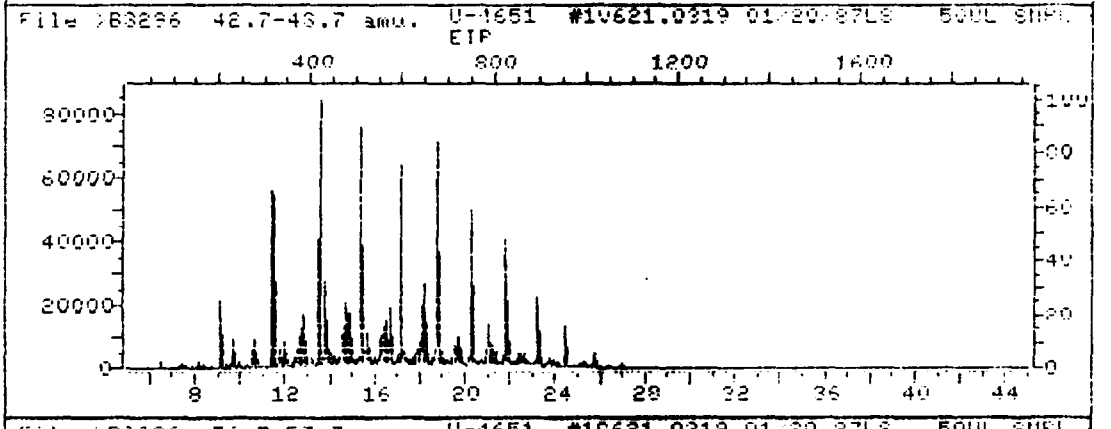
(5) Pesticide and PCB response factors and retention times do not always hold through the 12-hour analytical sequence. This has not been a problem with regular samples, and we attribute it to the highly contaminated nature of the Dead Creek samples. Would like to rely on analyst/supervisor judgment in identifying and quantifying "hits".

(6) It's taking a while to get the data packs out. Would a draft form data summary help? (Could be done quickly.)

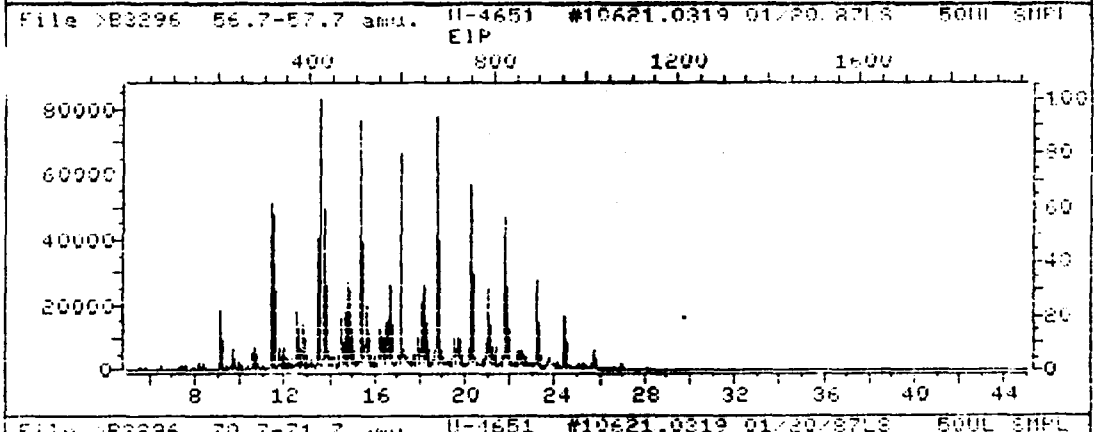
(7) A typical data pack can contain more than 20 separate tune results (listing, mass spectrum, and Form V for each) and 20 or more separate daily calibrations. Do IEPA require all these data?



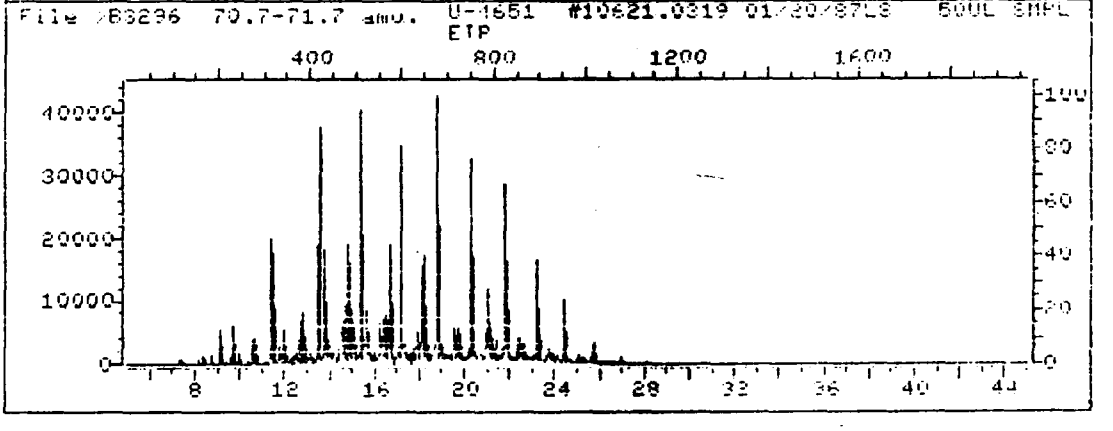
Total Ion Chromatogram



m/e 43

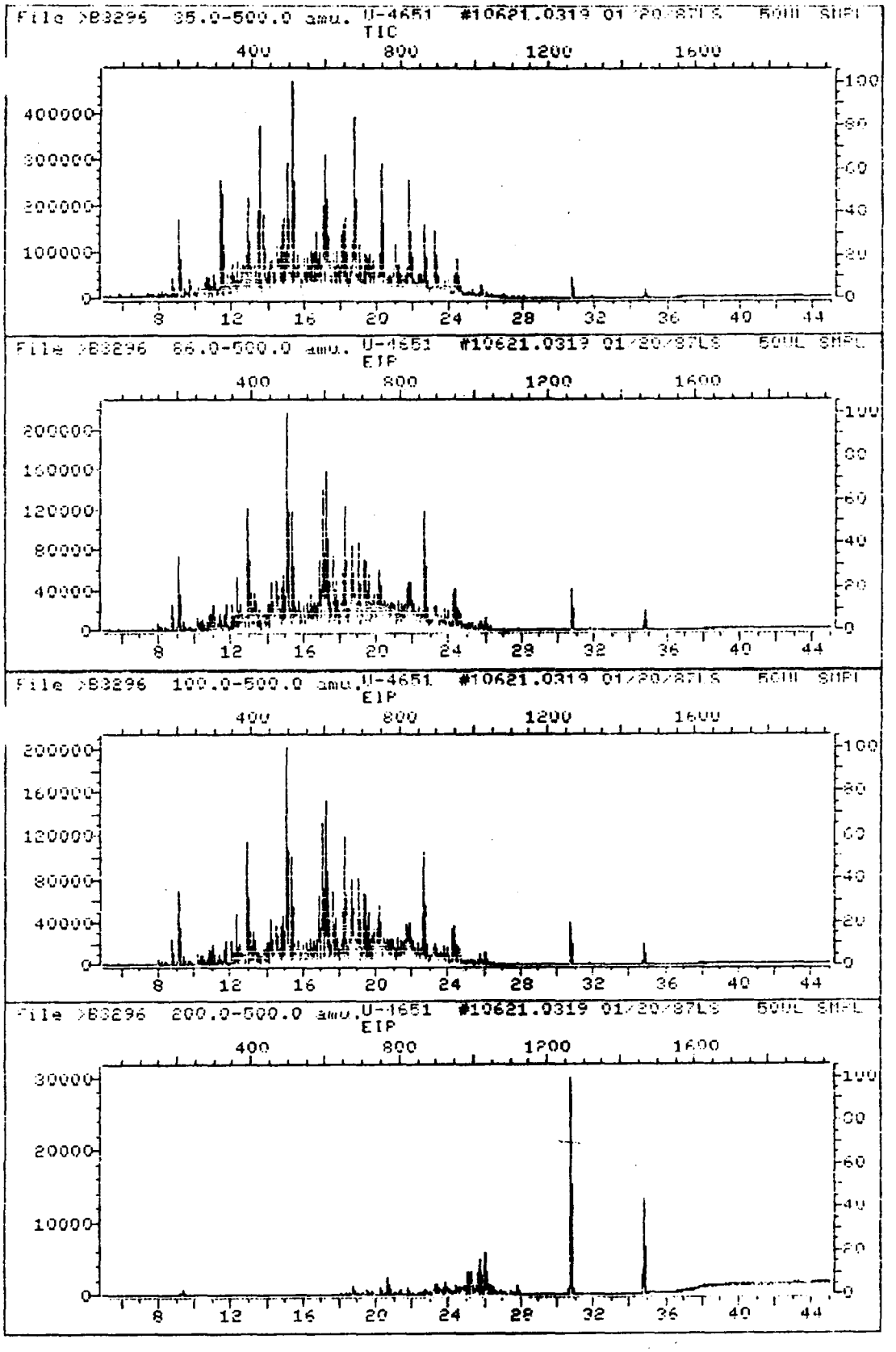


m/e 57



m/e 71

Mass spectra in long-channel ion mobility



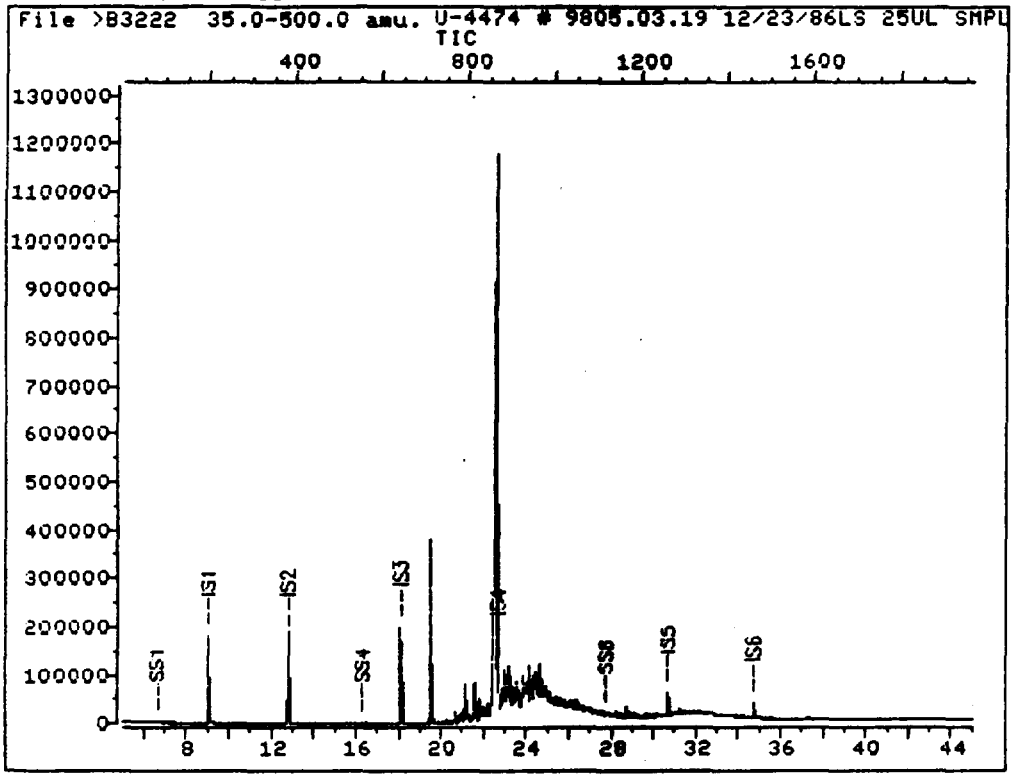
Total Ion Chromatogram

Scan 86 - 500 amu (less aliphatics)

100 - 500 amu

200 - 500 amu

TOTAL ION CHROMATOGRAM

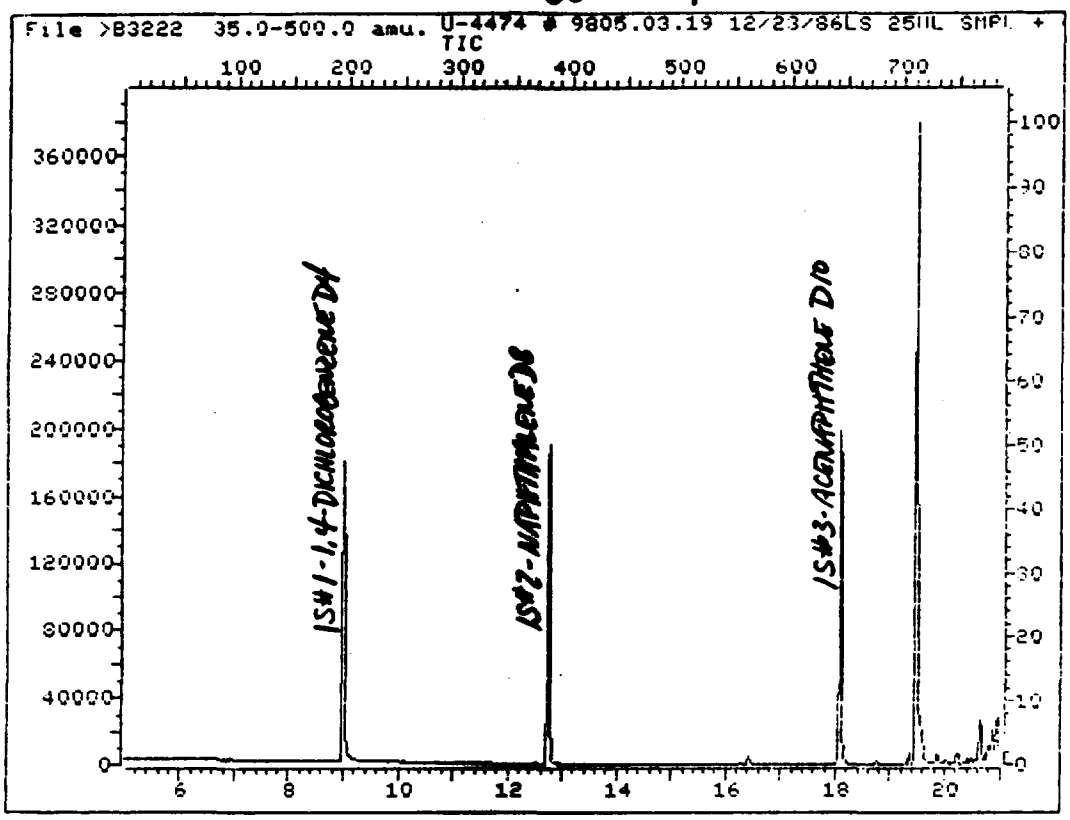


Data File: >B3222::D4
Name: U-4474 # 9805.03.19 DC-SS-39
Misc: 12/23/86LS 25UL SMPL + 475UL MECL2 + 5UL IS (20X)

Id File: BNABR::D2
Title: BNA ID FILE FOR THE HP 5970 (B)
Last Calibration: 861223 19:58

Operator ID: USER8
Quant Time: 861223 21:06
Injected at: 861223 20:18

DC-SS-39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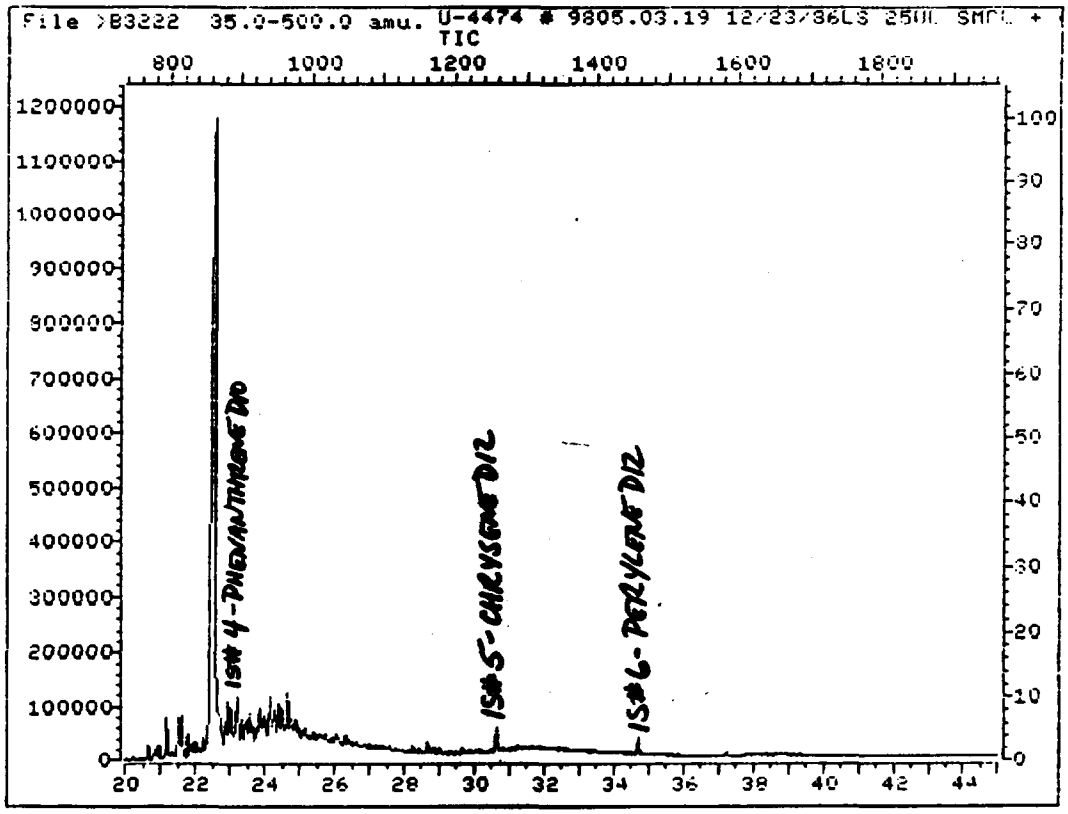
IS#1-1,4-DICHLOROBENZENE D4
IS#2-NAPHTHALENE D8
IS#3-ACENAPHTHENE D10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TIC
IS# 4-PHENANTHRENE D10
IS#5-CHRYSENE D12
IS#6-PERYLENE D12

QUANT REPORT

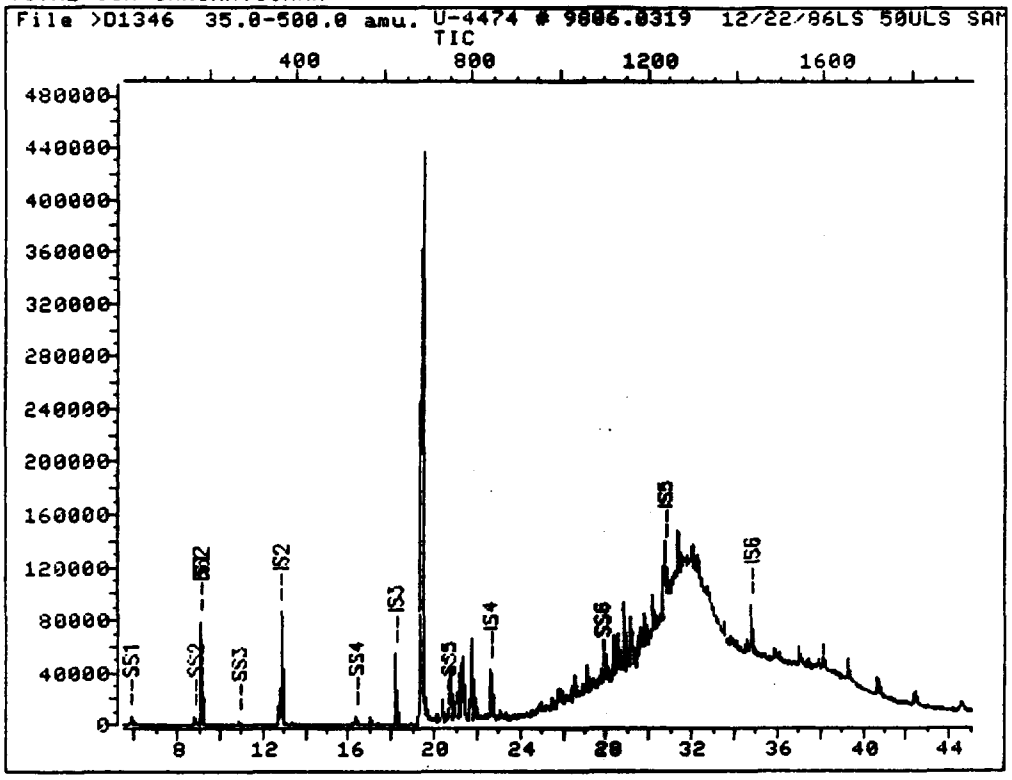
Operator ID: USER8 Quant Rev: 4 Quant Time: 861223 21:06
Output File: ^83222::Q2 Injected at: 861223 20:18
Data File: >83222::D4 Dilution Factor: 20.00
Name: U-4474 # 9805.03.19 DC-SS-39
Misc: 12/23/86LS 25UL SMPL + 475UL MECL2 + 5UL IS (20X) FINAL VOLUME - 5.0ml

ID File: BNABR::D2
Title: BNA ID FILE FOR THE HP 5970 (B)
Last Calibration: 861223 19:58

	Compound		M/E	R.T.	Scan#	Area	Conc	Units	q
1)	*1,4-DICHLOROBENZENE-D4	(IS)	152	9.00	197	76754	40.00	UG/L	88
5)	2-FLUOROPHENOL	(SURR)	112	6.58	78	669	14.32	UG/L	84
19)	*NAPHTHALENE-D8	(IS)	136	12.74	381	265415	40.00	UG/L	100
28)	1,2,4-TRICHLOROBENZENE		180	12.70	379	1035	8.57	UG/L	100
~~29)~~	~~NAPHTHALENE~~		~~128~~	~~12.80~~	~~384~~	~~386~~	~~1.21~~	~~UG/L~~	~~100~~
34)	*ACENAPHTHENE-D10	(IS)	162	18.09	644	127159	40.00	UG/L	97
38)	2-FLUOROBIPHENYL	(SURR)	172	16.28	555	1711	6.82	UG/L	94
~~41)~~	~~DIMETHYL PHTHALATE~~		~~163~~	~~10.11~~	~~645~~	~~37991~~	~~155.65~~	~~UG/L~~	100
~~41)~~	~~DIMETHYL PHTHALATE~~		~~163~~	~~10.15~~	~~647~~	~~766~~	~~3.14~~	~~UG/L~~	100
~~52)~~	~~2,6-DINITROTOLUENE~~		~~165~~	~~10.09~~	~~644~~	~~16166~~	~~274.44~~	~~UG/L~~	100
~~52)~~	~~2,6-DINITROTOLUENE~~		~~165~~	~~10.15~~	~~647~~	~~131~~	~~2.22~~	~~UG/L~~	100
55)	*PHENANTHRENE-D10	(IS)	188	22.62	867	82315	40.00	UG/L	98
60)	PENTACHLOROPHENOL		266	22.56	864	1387942	97734.97	UG/L	100
~~)~~	~~PENTACHLOROPHENOL~~		~~266~~	~~22.62~~	~~867~~	~~18704~~	~~1317.08~~	~~UG/L~~	100
65)	*CHRYSENE-D12	(IS)	240	30.64	1260	49591	40.00	UG/L	100
~~66)~~	~~BENZIDINE~~		~~184~~	~~26.99~~	~~1001~~	~~298~~	~~298.00~~	~~NO CALIB~~	~~100~~
68)	TERPHENYL-D14	(SURR)	244	27.72	1117	349	5.56	UG/L	100
~~70)~~	~~3,3'DICHLOROBENZIDINE~~		~~252~~	~~31.25~~	~~1290~~	~~446~~	~~43.14~~	~~UG/L~~	100
74)	*PERYLENE-D12	(IS)	264	34.69	1459	38795	40.00	UG/L	100
~~75)~~	~~DI-N-OCTYL PHTHALATE~~		~~149~~	~~33.43~~	~~1397~~	~~138~~	~~1.48~~	~~UG/L~~	100
~~76)~~	~~BENZO(B)FLUORANTHENE~~		~~252~~	~~33.76~~	~~1413~~	~~357~~	~~5.82~~	~~UG/L~~	100
~~77)~~	~~BENZO(K)FLUORANTHENE~~		~~252~~	~~33.76~~	~~1413~~	~~357~~	~~6.84~~	~~UG/L~~	100
78)	BENZO(A)PYRENE		252	34.43	1446	921	17.94	UG/L	100
~~79)~~	~~BENZO(A)PYRENE~~		~~252~~	~~34.55~~	~~1452~~	~~290~~	~~5.66~~	~~UG/L~~	100
~~81)~~	~~BENZO(G,H,I)PERYLENE~~		~~276~~	~~37.05~~	~~1614~~	~~502~~	~~10.96~~	~~UG/L~~	100

* Compound is ISTD

TOTAL ION CHROMATOGRAM



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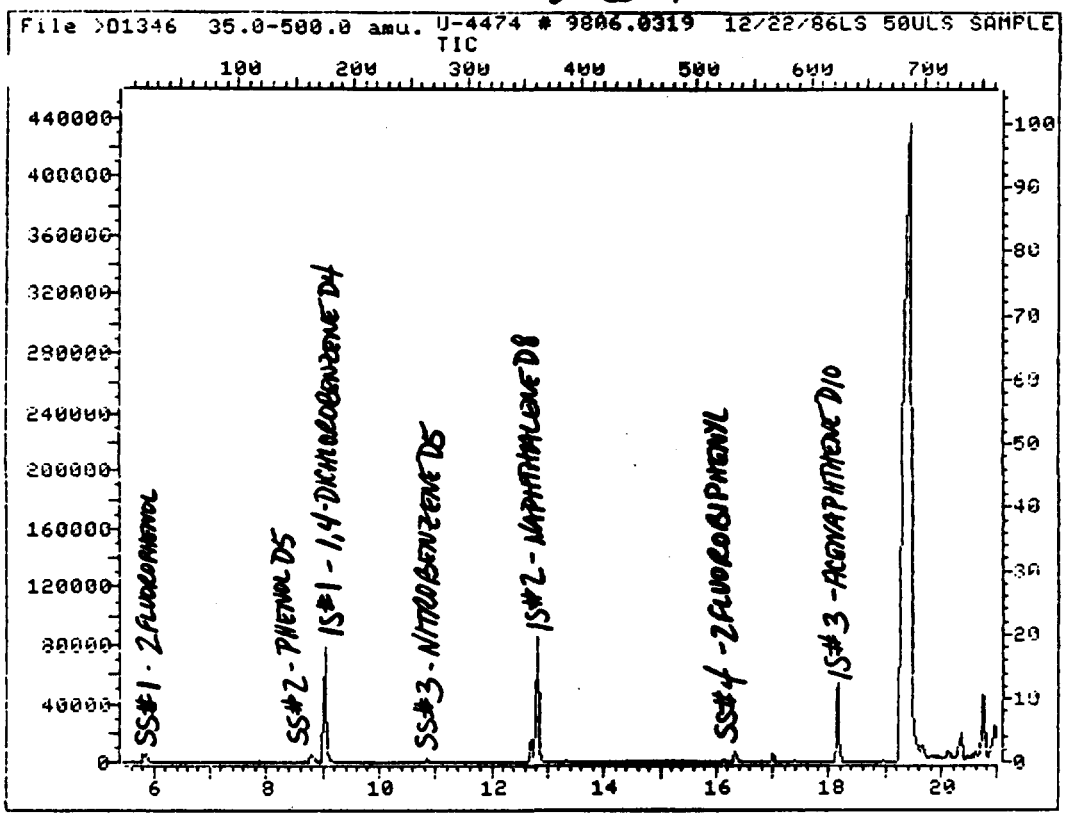
Name: U-4474 # 9806.0319
Misc: 12/22/86LS 50ULS SAMPLE + 450ULS MECL2 + 5ULS IS BTL# 4

Id File: BNADR::D2
Title: BNA ID FILE FOR THE HP 5970 (B)
Last Calibration: 861222 15:30

Operator ID: USER6
Quant Time: 861222 22:02
Injected at: 861222 21:15

DC-SS-40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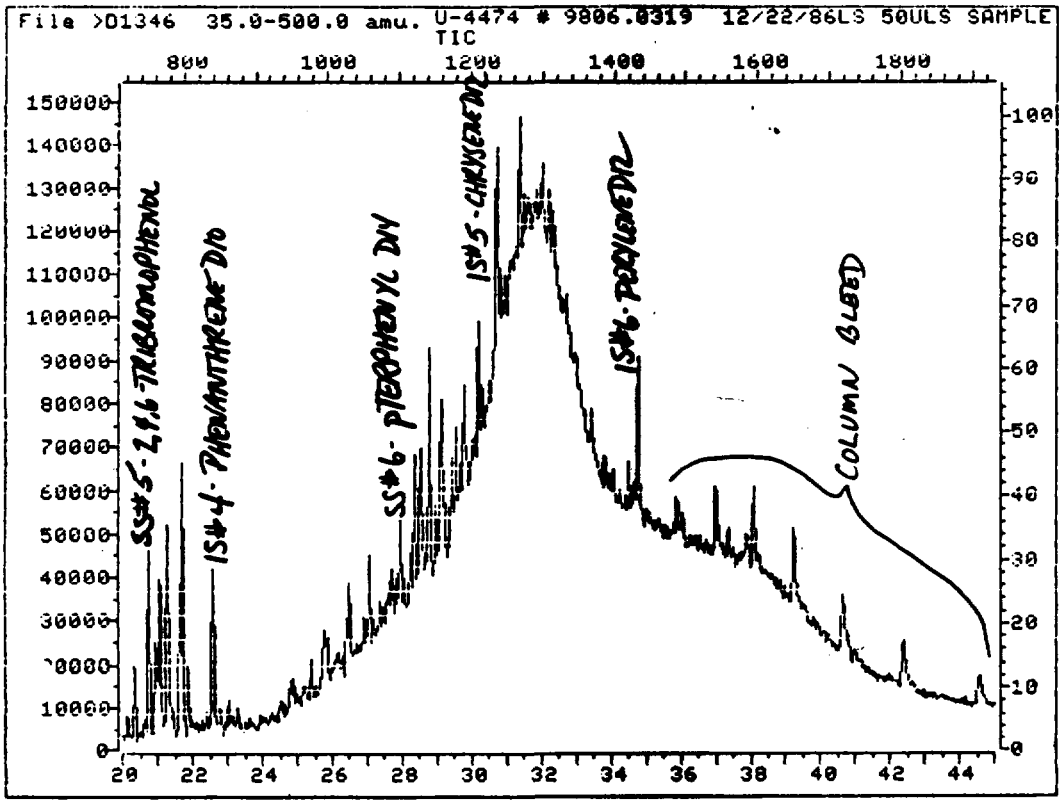
SS#2 - Phenol D5
IS#1 - 1,4-Dichlorobenzene D4
SS#3 - Nitrobenzene D5
IS#2 - Naphthalene D8
SS#4 - 2-Fluorobiphenyl
IS#3 - Acenaphthene D10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TIC
SS#5 - 2,4,6-Tribromophenol
IS#4 - Phenanthrene D10
SS#6 - p-Terphenyl D14
IS#5 - Chrysene D12
IS#6 - Perylene D12
Column Bleed

QUANT REPORT

Operator ID: USER6 Quant Rev: 4 Quant Time: 861222 22:02
Output File: ^D1346::Q2 Injected at: 861222 21:15
Data File: >D1346::D2 Dilution Factor: 10.00
Name: U-4474 # 9806.0319 DC-SS-40
Misc: 12/22/86LS 50ULS SAMPLE + 450ULS MECL2 + 5ULS IS BTL# 4

ID File: BNADR::D2
Title: BNA ID FILE FOR THE HP 5970 (B)
Last Calibration: 861222 15:30

	Compound		M/E	R.T.	Scan#	Area	Conc	Units	q
1)	*1,4-DICHLOROBENZENE-D4	(IS)	152	9.04	176	38701	40.00	UG/L	87
2)	PHENOL-D5	(SURR)	99	8.79	164	8431	68.86	UG/L	97
~~2)~~	~~PHENOL-D5~~	~~(SURR)~~	~~99~~	~~9.04~~	~~176~~	~~655~~	~~5.35~~	~~UG/L~~	~~99~~
5)	2-FLUOROPHENOL	(SURR)	112	5.80	17	6559	73.90	UG/L	99
~~17)~~	~~N-NITROSO-DI-N-PROPYLAMINE~~		~~70~~	~~10.85~~	~~265~~	~~474~~	~~5.88~~	~~UG/L~~	84
19)	*NAPHTHALENE-D8	(IS)	136	12.81	361	121419	40.00	UG/L	100
20)	NITROBENZENE-D5	(SURR)	82	10.85	265	3843	39.94	UG/L	95
27)	2,4-DICHLOROPHENOL		162	12.68	355	16817	154.96	UG/L	93
~~29)~~	~~NAPHTHALENE~~		~~128~~	~~12.60~~	~~355~~	~~494~~	~~1.85~~	~~UG/L~~	100
29)	NAPHTHALENE		128	12.87	364	968	3.63	UG/L	100
34)	*ACENAPHTHENE-D10	(IS)	162	18.16	624	35360	40.00	UG/L	97
36)	2,4,6-TRICHLOROPHENOL		196	16.13	524	1867	38.27	UG/L	99
~~37)~~	~~2,4,5-TRICHLOROPHENOL~~		~~196~~	~~16.13~~	~~524~~	~~1867~~	~~38.27~~	~~UG/L~~	97
8)	2-FLUOROBIPHENYL	(SURR)	172	16.33	534	9083	64.04	UG/L	92
~~41)~~	~~DIMETHYL PHTHALATE~~		~~163~~	~~18.16~~	~~624~~	~~11033~~	~~88.67~~	~~UG/L~~	100
48)	2,4,6-TRIBROMOPHENOL	(SURR)	330	20.63	745	2069	49.09	UG/L	93
50)	4-NITROPHENOL		139	19.45	687	599870	25681.33	UG/L	100
50)	4-NITROPHENOL		139	19.49	689	15414	659.90	UG/L	100
~~51)~~	~~2,4-DINITROTOLUENE~~		~~165~~	~~19.53~~	~~691~~	~~177~~	~~7.30~~	~~UG/L~~	100
~~52)~~	~~2,6-DINITROTOLUENE~~		~~165~~	~~18.16~~	~~624~~	~~4375~~	~~157.77~~	~~UG/L~~	100
55)	*PHENANTHRENE-D10	(IS)	188	22.57	840	45031	40.00	UG/L	90
60)	PENTACHLOROPHENOL		266	22.40	832	684	28.45	UG/L	100
61)	PHENANTHRENE		178	22.63	843	2453	23.03	UG/L	92
~~61)~~	~~PHENANTHRENE~~		~~178~~	~~22.77~~	~~850~~	~~2104~~	~~19.75~~	~~UG/L~~	91
~~62)~~	~~ANTHRACENE~~		~~178~~	~~22.63~~	~~843~~	~~2453~~	~~23.43~~	~~UG/L~~	92
62)	ANTHRACENE		178	22.77	850	2104	20.10	UG/L	91
63)	DI-N-BUTYLPHTHALATE		149	25.16	967	1998	21.94	UG/L	80
64)	FLUORANTHENE		202	26.28	1022	5141	63.53	UG/L	95
65)	*CHRYSENE-D12	(IS)	240	30.72	1238	44249	40.00	UG/L	100
~~66)~~	~~BENZIDINE~~		~~184~~	~~26.94~~	~~1054~~	~~234~~	~~234.00~~	~~NO CALIB~~	100
~~66)~~	~~BENZIDINE~~		~~184~~	~~27.00~~	~~1057~~	~~430~~	~~430.00~~	~~NO CALIB~~	100
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~~66)~~	~~BENZIDINE~~		~~184~~	~~27.58~~	~~1085~~	~~433~~	~~433.00~~	~~NO CALIB~~	100
67)	PYRENE		202	26.90	1052	8785	60.06	UG/L	94
68)	TERPHENYL-D14	(SURR)	244	27.78	1095	3695	41.54	UG/L	100
~~69)~~	~~BUTYLBENZYLPHTHALATE~~		~~149~~	~~29.55~~	~~1181~~	~~1312~~	~~22.93~~	~~UG/L~~	50
~~70)~~	~~3,3'DICHLOROBENZIDINE~~		~~252~~	~~30.70~~	~~1237~~	~~1718~~	~~70.06~~	~~UG/L~~	100
~~70)~~	~~3,3'DICHLOROBENZIDINE~~		~~252~~	~~30.82~~	~~1243~~	~~776~~	~~31.65~~	~~UG/L~~	100
~~70)~~	~~3,3'DICHLOROBENZIDINE~~		~~252~~	~~30.93~~	~~1248~~	~~371~~	~~15.13~~	~~UG/L~~	100
~~70)~~	~~3,3'DICHLOROBENZIDINE~~		~~252~~	~~31.19~~	~~1261~~	~~379~~	~~15.46~~	~~UG/L~~	100
~~70)~~	~~3,3'DICHLOROBENZIDINE~~		~~252~~	~~31.34~~	~~1268~~	~~3587~~	~~146.28~~	~~UG/L~~	100
71)	BENZO(A)ANTHRACENE		228	30.68	1236	3575	33.30	UG/L	92
~~71)~~	~~BENZO(A)ANTHRACENE~~		~~228~~	~~30.78~~	~~1241~~	~~6833~~	~~63.65~~	~~UG/L~~	91
~~72)~~	~~BIS(2-ETHYLHEXYL)PHTHALATE~~		~~149~~	~~31.58~~	~~1280~~	~~193~~	~~2.36~~	~~UG/L~~	64

	Compound		m/e	R.T.	Scan#	Area	Conc	Units	q
~~73)~~	~~CHRYSENE~~		~~228~~	~~30.68~~	~~1236~~	~~3575~~	~~33.08~~	~~UG/L~~	91
73)	CHRYSENE		228	30.78	1241	6833	63.23	UG/L	92
74)	*PERYLENE-D12	(IS)	264	34.77	1435	47494	40.00	UG/L	100
~~75)~~	~~DI-N-OCTYL PHTHALATE~~		~~149~~	~~33.05~~	~~1351~~	~~158~~	~~.96~~	~~UG/L~~	100
~~75)~~	~~DI-N-OCTYL PHTHALATE~~		~~149~~	~~33.27~~	~~1362~~	~~308~~	~~1.88~~	~~UG/L~~	100
~~75)~~	~~DI-N-OCTYL PHTHALATE~~		~~149~~	~~33.52~~	~~1374~~	~~234~~	~~1.42~~	~~UG/L~~	100
~~75)~~	~~DI-N-OCTYL PHTHALATE~~		~~149~~	~~33.83~~	~~1389~~	~~193~~	~~1.17~~	~~UG/L~~	100
~~75)~~	~~DI-N-OCTYL PHTHALATE~~		~~149~~	~~33.99~~	~~1397~~	~~182~~	~~1.11~~	~~UG/L~~	100
~~76)~~	~~BENZO(B)FLUORANTHENE~~		~~252~~	~~33.44~~	~~1370~~	~~227~~	~~1.52~~	~~UG/L~~	100
76)	BENZO(B)FLUORANTHENE		252	33.81	1388	13343	89.56	UG/L	100
~~76)~~	~~BENZO(B)FLUORANTHENE~~		~~252~~	~~33.99~~	~~1397~~	~~196~~	~~1.32~~	~~UG/L~~	100
~~76)~~	~~BENZO(B)FLUORANTHENE~~		~~252~~	~~34.18~~	~~1402~~	~~1797~~	~~12.06~~	~~UG/L~~	100
~~76)~~	~~BENZO(B)FLUORANTHENE~~		~~252~~	~~34.24~~	~~1409~~	~~205~~	~~1.38~~	~~UG/L~~	100
~~77)~~	~~BENZO(K)FLUORANTHENE~~		~~252~~	~~33.44~~	~~1370~~	~~227~~	~~1.97~~	~~UG/L~~	100
~~77)~~	~~BENZO(K)FLUORANTHENE~~		~~252~~	~~33.81~~	~~1388~~	~~13343~~	~~115.77~~	~~UG/L~~	100
~~77)~~	~~BENZO(K)FLUORANTHENE~~		~~252~~	~~33.99~~	~~1397~~	~~196~~	~~1.70~~	~~UG/L~~	100
~~77)~~	~~BENZO(K)FLUORANTHENE~~		~~252~~	~~34.18~~	~~1402~~	~~1797~~	~~15.59~~	~~UG/L~~	100
~~77)~~	~~BENZO(K)FLUORANTHENE~~		~~252~~	~~34.24~~	~~1409~~	~~205~~	~~1.78~~	~~UG/L~~	100
~~78)~~	~~BENZO(A)PYRENE~~		~~252~~	~~34.24~~	~~1409~~	~~205~~	~~1.69~~	~~UG/L~~	100
~~78)~~	~~BENZO(A)PYRENE~~		~~252~~	~~34.49~~	~~1421~~	~~7656~~	~~63.14~~	~~UG/L~~	100
78)	BENZO(A)PYRENE		252	34.61	1427	5263	43.41	UG/L	100
~~78)~~	~~BENZO(A)PYRENE~~		~~252~~	~~34.75~~	~~1434~~	~~257~~	~~2.12~~	~~UG/L~~	100
~~78)~~	~~BENZO(A)PYRENE~~		~~252~~	~~34.84~~	~~1438~~	~~1420~~	~~11.71~~	~~UG/L~~	100
~~79)~~	~~INDENO(1,2,3-CD)PYRENE~~		~~276~~	~~36.97~~	~~1542~~	~~394~~	~~3.15~~	~~UG/L~~	100
~~79)~~	~~INDENO(1,2,3-CD)PYRENE~~		~~276~~	~~37.16~~	~~1551~~	~~1685~~	~~13.48~~	~~UG/L~~	100
79)	INDENO(1,2,3-CD)PYRENE		276	37.37	1561	6578	52.61	UG/L	100
~~79)~~	~~INDENO(1,2,3-CD)PYRENE~~		~~276~~	~~37.67~~	~~1576~~	~~458~~	~~3.68~~	~~UG/L~~	100
~~79)~~	~~INDENO(1,2,3-CD)PYRENE~~		~~276~~	~~37.76~~	~~1580~~	~~630~~	~~5.04~~	~~UG/L~~	100
~~80)~~	~~DIBENZ(A,H)ANTHRACENE~~		~~278~~	~~36.97~~	~~1542~~	~~468~~	~~3.96~~	~~UG/L~~	100
~~80)~~	~~DIBENZ(A,H)ANTHRACENE~~		~~278~~	~~37.10~~	~~1550~~	~~2430~~	~~20.91~~	~~UG/L~~	100
80)	DIBENZ(A,H)ANTHRACENE		278	37.47	1566	1542	13.27	UG/L	100
~~80)~~	~~DIBENZ(A,H)ANTHRACENE~~		~~278~~	~~37.69~~	~~1577~~	~~852~~	~~7.33~~	~~UG/L~~	100
~~80)~~	~~DIBENZ(A,H)ANTHRACENE~~		~~278~~	~~37.76~~	~~1580~~	~~1829~~	~~15.74~~	~~UG/L~~	100
~~81)~~	~~BENZO(G,H,I)PERYLENE~~		~~276~~	~~37.67~~	~~1576~~	~~458~~	~~3.45~~	~~UG/L~~	100
~~81)~~	~~BENZO(G,H,I)PERYLENE~~		~~276~~	~~37.76~~	~~1580~~	~~630~~	~~4.83~~	~~UG/L~~	100
81)	BENZO(G,H,I)PERYLENE		276	37.88	1586	7984	61.15	UG/L	100
~~81)~~	~~BENZO(G,H,I)PERYLENE~~		~~276~~	~~38.11~~	~~1597~~	~~346~~	~~2.65~~	~~UG/L~~	100
~~81)~~	~~BENZO(G,H,I)PERYLENE~~		~~276~~	~~38.21~~	~~1602~~	~~653~~	~~5.00~~	~~UG/L~~	100

* Compound is ISTD

ecology and environment, inc.

HAZARD EVALUATION OF CHEMICALS

Chemical Name 2,3,7,8 tetrachlorodibenzo- Date 9-22-86

DOT Name/U.N. No. None Job No. IL-3020

CAS Number 1746-01-6

References Consulted (circle):

NIOSH/OSHA Pocket Guide (Verschueren) (Merck Index) Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: RTECS

Chemical Properties: (Synonyms: Dioxin, TCDD)

Chemical Formula $C_{12}H_4O_2Cl_4$ Molecular Weight 322 afw

Physical State Crystalline solid Solubility (H_2O) 0.2 Boiling Point Decomposes at >1292°F

Flash Point N/A Vapor Pressure/Density 1.7×10^{-6} Freezing Point N/A

Specific Gravity 1.075 @ 25°C Odor/Odor Threshold -- @ 770°F Flammable Limits N/A

Incompatabilities Unknown

Biological Properties:

TLV-TWA Not established PEL Not established Odor Characteristic --

IDLH 22,500 ng/kg Human -- Aquatic -- Rat/Mouse Oral LD_{50} = 22 ug/kg

Route of Exposure Dermal, inhalation, ingestion

Carcinogen Suspected Teratogen Animal (RTECS) Mutagen Positive (RTECS)

EPA/CDC level in soil is 1 ppb

Handling Recommendations: (Personal protective measures)

Supplied air suggested, coated, chemically resistant coveralls, butyl or neoprene boots and gloves. Avoid all contact with skin.

Monitoring Recommendations:

Monitor for dust in the air.

Disposal/Waste Treatment:

Remove from environment and store safely until an approved disposal site can be located (store in sealed, non-reusable containers).

Health Hazards and First Aid: Eyes: Wash immediately with copious amounts of water. Skin: Wash with soap or mild detergent and water. Inhalation: Remove to fresh air (AR if necessary). Ingestion: Give water, then induce vomitting.

Symptoms: Acute: Chloracne, skin and eye irritation, fatigue, respiratory distress, mental depression.

Chronic: Chloracne, hepatic neurosis, hemmorrhage, emphysema, liver, thyroid, skin, and kidney carcinogens. CNS depression.

575103

(12/83,DLO)

ARSENIC TRICHLORIDE

AST

Common Synonyms	Liquid	Colorless	Unpleasant odor
Fuming liquid arsenic Arsenic chloride Arsenous chloride Caustic arsenic chloride Arsenious chloride Butter of arsenic	Sinks and reacts in water. Poisonous visible vapor cloud is produced.		

AVOID CONTACT WITH LIQUID AND VAPOR. KEEP PEOPLE AWAY.
Wear goggles and self-contained breathing apparatus.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not Flammable.
POISONOUS GASES ARE PRODUCED WHEN HEATED.

Exposure

CALL FOR MEDICAL AID.

VAPOR
POISONOUS IF INHALED.
Move victim to fresh air.
If breathing is difficult, give oxygen.

LIQUID
POISONOUS IF SWALLOWED.
Irritating to skin and eyes.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-poison, water contaminant, corrosive
Restrict access
Disperse and flush

2. LABEL

2.1 Category: Poison
2.2 Class: 6

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $AsCl_3$
3.3 IMO/UN Designation: 6.1/1560
3.4 DOT ID No.: 1560
3.5 CAS Registry No.: 7784-34-1

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Acrid

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Safety goggles and face shield; acid-type canister gas mask; rubber gloves; protective clothing.
5.2 Symptoms Following Exposure: Inhalation causes irritation of nose and throat. Contact of liquid with eyes or skin causes severe irritation. Ingestion causes weakness and severe irritation of mouth and stomach. Overdose can cause severe poisoning, but symptoms are delayed.
5.3 Treatment of Exposure: Get medical attention after all exposures to this compound. Be alert for arsenic poisoning symptoms. INHALATION: remove to fresh air; give artificial respiration if needed. EYES: flush with water for at least 15 min. SKIN: flush with water. INGESTION: give large amounts of water, then induce vomiting; give lime water, milk, or raw egg; give a cathartic.
5.4 Threshold Limit Value: 0.2 mg/m³ as arsenic
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 2; oral rat LD_{50} = 139 mg/kg; fatal human dose 70-180 mg, depending on weight.
5.7 Late Toxicity: Arsenic compounds may be carcinogenic.
5.8 Vapor (Gas) Irritant Characteristics: Data not available
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Avoid water on adjacent fires.
6.5 Special Hazards of Combustion Products: Irritating and toxic hydrogen chloride formed when involved in fire.
6.6 Behavior in Fire: Becomes gaseous and causes irritation. Forms hydrogen chloride (hydrochloric acid) by reaction with water used on adjacent fires.
6.7 Ignition Temperature: Not pertinent
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Not pertinent

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Reacts with water to generate hydrogen chloride (hydrochloric acid).
7.2 Reactivity with Common Materials: Corrodes metal.
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Flush with water, rinse with sodium bicarbonate or lime solution.
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Water Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Commercial
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-O

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Poison, B
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 16°C and 1 atm: Liquid
12.2 Molecular Weight: 181.3
12.3 Boiling Point at 1 atm: 266.4°F = 130.2°C = 403.4°K
12.4 Freezing Point: 9°F = −13°C = 260°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 2.155 at 25°C (liquid)
12.8 Liquid Surface Tension: (est.) 50 dynes/cm = 0.050 N/m at 20°C
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: 89.31 Btu/lb = 49.05 cal/g = 2.054 X 10⁵ J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: (est.) −16 Btu/lb = -10 cal/g = -0.42 X 10⁵ J/kg
12.16 Heat of Polymerization: Not pertinent
12.35 Heat of Fusion: 13.3 cal/g
12.36 Limiting Value: Data not available
12.37 Reid Vapor Pressure: Data not available

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Not pertinent
6.12 Flame Temperature: Not pertinent

CHRIS, Vol. III

JUNE 1985

CADMIUM NITRATE

CMN

Common Synonyms	Solid	White	Odorless
Cadmium nitrate tetrahydrate	Soluble in water.		

AVOID CONTACT WITH SOLID AND DUST. KEEP PEOPLE AWAY.
Wear a dust respirator.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
POISONOUS GASES MAY BE PRODUCED IN FIRE.
Wear goggles and self-contained breathing apparatus.

Exposure

CALL FOR MEDICAL AID.

DUST
POISONOUS IF INHALED.
If inhaled will cause headache, coughing, or difficult breathing.
If in eyes, hold eyelids open and flush with plenty of water.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

SOLID
POISONOUS IF SWALLOWED.
Irritating to skin and eyes.
If swallowed will cause nausea and vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-water contaminant
Disperse and flush

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $Cd(NO_3)_2 \cdot 4H_2O$
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: 2570
3.5 CAS Registry No.: 10022-68-1

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: White
4.3 Odor: None

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Rubber gloves; safety goggles; dust mask
5.2 Symptoms Following Exposure: Inhalation of fumes can produce coughing, chest constriction, headache, nausea, vomiting, pneumonitis. Chronic poisoning is characterized by emphysema and kidney injury. Ingestion causes gastrointestinal disturbance and severe toxic symptoms; both kidney and liver injuries may occur. Contact with eyes causes irritation.
5.3 Treatment of Exposure: INHALATION: remove patient to fresh air; seek medical attention. INGESTION: give large amounts of water and induce vomiting; give milk or egg whites; seek medical attention. EYES: flush with copious amounts of water for 15 min.; consult a physician. SKIN: wash with soap and water.
5.4 Threshold Limit Value: 0.05 mg/m³ (as cadmium)
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 3; oral mouse LD_{50} = 140 mg/kg
5.7 Late Toxicity: Delayed liver, lung, and kidney damage has followed respiratory exposures to cadmium salts in industry.
5.8 Vapor (Gas) Irritant Characteristics: Data not available
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Odorless
5.11 IDLH Value: 40 mg/m³ as Cd

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic oxides of nitrogen and cadmium oxide fumes may form in fires.
6.6 Behavior in Fire: Will increase intensity of fire when in contact with combustible material
6.7 Ignition Temperature: Not pertinent
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: Data not available
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
0.056 ppm*/**/guppy/LD_{50}/fresh water
0.2 ppm/10 days/stickleback/killed/fresh water
*As cadmium
**Type period not specified
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: Shellfish concentrate 900-1600 times

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

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11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 MAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 308.47
12.3 Boiling Point at 1 atm: Not pertinent (decomposes)
12.4 Freezing Point:
130°F = 59°C = 332°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity:
2.46 at 20°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: 29.7 Btu/lb
= 16.5 cal/g = 0.691 X 10^3 J/kg
12.16 Heat of Polymerization: Not pertinent
12.35 Heat of Fusion: Data not available
12.36 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

CHRIS, NO. III

p-CHLOROTOLUENE

CRN

Common Synonyms	Liquid	Colorless
p-Tolyl chloride 4-Chloro-1-methylbenzene 4-Chlorotoluene 1-Chloro-4-methylbenzene	Sinks slowly in water.	

Avoid contact with liquid. Keep people away.
Wear goggles and self-contained breathing apparatus.
Stop discharge if possible. Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

COMBUSTIBLE
Wear goggles and self-contained breathing apparatus.
Extinguish with alcohol foam, carbon dioxide or dry chemical.

Exposure

CALL FOR MEDICAL AID.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and induce vomiting.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Restrict access.
Chemical and physical treatment.
Disperse and flush.

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated compound
3.2 Formula: C_7H_7Cl
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: 2238
3.5 CAS Registry No.: 106-43-4

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Characteristic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Respirator with proper filter, goggles.
5.2 Symptoms Following Exposure: INHALATION: Irritation of respiratory system. EYES AND SKIN: Severe irritation. INGESTION: Severe internal damage if swallowed.
5.3 Treatment of Exposure: Get medical aid. INHALATION: Move to fresh air. Remove contaminated clothing. Keep warm and quiet. If breathing has stopped give artificial respiration. EYES AND SKIN: Wash with plenty of water. INGESTION: Give one or two glasses of water or milk. Induce vomiting. Give cathartics.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Data not available
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Data not available
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 138°F C.C.
6.2 Flammable Limits in Air: Data not available
6.3 Fire Extinguishing Agents: Alcohol foam; CO_2; Dry chemical
6.4 Fire Extinguishing Agents Not to be Used: Data not available
6.5 Special Hazards of Combustion Products: Data not available
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Data not available
6.8 Electrical Hazard: Data not available
6.9 Burning Rate: Data not available
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Data not available
7.2 Reactivity with Common Materials: Data not available
7.3 Stability During Transport: Data not available
7.4 Neutralizing Agents for Acids and Caustics: Data not available
7.5 Polymerization: Data not available
7.6 Inhibitor of Polymerization: Data not available
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: 1-10 ppm/96 hour/Finfish/TL_m
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Data not available
9.2 Storage Temperature: Data not available
9.3 Inert Atmosphere: Data not available
9.4 Venting: Data not available

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

AX

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 16°C and 1 atm: Liquid
12.2 Molecular Weight: 126.6
12.3 Boiling Point at 1 atm: 324°F = 162°C = 435.2°K
12.4 Freezing Point: 46.5°F = 7.50°C = 280.7°K
12.5 Critical Temperature: Data not available
12.6 Critical Pressure: Data not available
12.7 Specific Gravity: 1.0697 at 20°C
12.8 Liquid Surface Tension: 32.24 dynes/cm = 0.03224 N/m at 25°C
12.9 Liquid Water Interfacial Tension: Data not available
12.10 Vapor (Gas) Specific Gravity: 4.36 (estimated)
12.11 Ratio of Specific Heats of Vapor (Gas): Data not available
12.12 Latent Heat of Vaporization: At boiling point 130.8 Btu/lb = 76 cal/g = 3.18×10^5 J/kg
12.13 Heat of Combustion: Data not available
12.14 Heat of Decomposition: Data not available
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Data not available
12.17 Heat of Fusion: Data not available
12.18 Limiting Value: Data not available
12.19 Reid Vapor Pressure: Data not available

NOTES

CHRIS, VOL. III

NOVEMBER 1984

o-DICHLOROBENZENE

DBO

Common Synonyms	Liquid	Colorless	Pleasant odor
1, 2-Dichlorobenzene Orthodichlorobenzene Dowtherm E	Sinks in water.		

Avoid contact with liquid.
Wear goggles and self-contained breathing apparatus.
Stop discharge if possible.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear goggles and self-contained breathing apparatus.
Extinguish with water, dry chemical, foam, or carbon dioxide.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

USCG
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.

Notify local health and pollution control officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-water contaminant
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated hydrocarbon
3.2 Formula: $o\text{-}C_6H_4Cl_2$
3.3 BOD/ISI Designation: 0.1/1091
3.4 DOT ID No.: 1591
3.5 CAS Registry No.: 95-50-1

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Aromatic; characteristic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic vapor-acid gas respirator; neoprene or vinyl gloves; chemical safety spectacles, face shield, rubber footwear, apron, protective clothing.

5.2 Symptoms Following Exposure: Chronic inhalation of mist or vapors may result in damage to lungs, liver, and kidneys. Acute vapor exposure can cause symptoms ranging from coughing to central nervous system depression and transient anesthesia. Irritating to skin, eyes, and mucous membranes. May cause dermatitis.

5.3 Treatment of Exposure: INHALATION: remove victim to fresh air, keep him quiet and warm, and call a physician promptly. INGESTION: no known antidote; treat symptomatically; induce vomiting and get medical attention promptly. EYES AND SKIN: flush with plenty of water; get medical attention for eyes; remove contaminated clothing and wash before reuse.

5.4 Threshold Limit Value: 50 ppm

5.5 Short Term Inhalation Limits: 50 ppm for 15 min.

5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg

5.7 Late Toxicity: Causes kidney and liver damage in rats. Effects unknown in humans.

5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that appearance will first high concentrations unpleasant. The effect is temporary.

5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause scarring and reddening of the skin.

5.10 Odor Threshold: 4.8 ppm; 50 ppm

5.11 IDLH Value: 1,760 ppm

6. FIRE HAZARDS

6.1 Flash Point: 165°F O.C.; 150°F C.C.
6.2 Flammable Limits in Air: 2.2%-9.2%
6.3 Fire Extinguishing Agents: Water, foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Irritating vapors including hydrogen chloride gas, chlorocarbons, chlorine
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 1198°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 1.3 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 30

8. WATER POLLUTION

8.1 Aquatic Toxicity:
13 ppm/*/marine plankton/no growth/salt water
*Time period not specified.
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): <0.1% (theor.), 1/6 day
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical: 99.5% min. dichlorobenzene (ratio-ortho + para/meta: 80 min.) Technical: 85% orthodichlorobenzene, 14.0% paradichlorobenzene Technical: 80% ortho, 17% para, 2% meta Pure: not less than 99.5% ortho, not more than 0.5% para
9.2 Storage Temperature: Data not available
9.3 Inert Atmosphere: Data not available
9.4 Venting: Data not available

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-X-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	1
Health	
Vapor Irritant	2
Liquid or Solid Irritant	1
Poisons	1
Water Pollution	
Human Toxicity	2
Aquatic Toxicity	1
Aesthetic Effect	2
Reactivity	
Other Chemicals	2
Water	1
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 147.01
12.3 Boiling Point at 1 atm: 356.9°F = 180.5°C = 453.7°K
12.4 Freezing Point: 0.3°F = 17.8°C = 256.5°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.309 at 20°C (liquid)
12.8 Liquid Surface Tension: 37 dynes/cm = 0.037 N/m at 20°C
12.9 Liquid-Water Interfacial Tension: (est.) 40 dynes/cm = 0.04 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.080
12.12 Latent Heat of Vaporization: 115 Btu/lb = 63.9 cal/g = 2.68 X 10^5 J/kg
12.13 Heat of Combustion: −7900 Btu/lb = −4427 cal/g = −185.4 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.20 Heat of Fusion: 21.02 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.05 psia

NOTES

CHAIT, VOL. III

JUNE 1985

2,4-DICHLOROPHENOL

DCP

Common Synonyms	Solid crystals Colorless Medicinal odor Sinks in water.

Avoid contact with solid and dust. Keep people away.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	Combustible. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Extinguish with dry chemical, foam, or carbon dioxide. Cool exposed containers with water.
Exposure	CALL FOR MEDICAL AID. SOLID OR DUST Will burn skin and eyes. Poisonous if swallowed. Removes contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
Water Pollution	Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-water contaminant
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $HOC_6H_3Cl_2$-2,4
3.3 IMO/UN Designation: 6.1/2020
3.4 DOT ID No.: 2020
3.5 CAS Registry No.: 120-83-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: White
4.3 Odor: Strong medicinal

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Bureau of Mines approved respirator, rubber gloves, chemical goggles.
5.2 Symptoms Following Exposure: Tremors, convulsions, shortness of breath, inhibition of respiratory system.
5.3 Treatment of Exposure: Inhalation-rest; ingestion-drink water, epsom salt solution.
5.4 Threshold Limit Value: Not pertinent
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade II; LD_{50} = 0.5 to 5 g/kg (rat)
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Not pertinent
5.9 Liquid or Solid Irritant Characteristics: Fairly severe skin irritant. May cause pain and second-degree burns after a few minutes' contact.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 269°F O.C.; 257°F C.C.
6.2 Flammable Limits in Air: Data not available
6.3 Fire Extinguishing Agents: Water, foam, carbon dioxide, dry chemical
6.4 Fire Extinguishing Agents Not to be Used: Water or foam may cause boiling.
6.5 Special Hazards of Combustion Products: Toxic gases can be evolved.
6.6 Behavior in Fire: Solid melts and burns.
6.7 Ignition Temperature: Data not available
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: May react vigorously with oxidizing materials
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
5 ppm/3 hours/rainbow trout/killed/fresh water
5 ppm/12 hours/bluegills/killed/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 100%, 5 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Data not available
9.2 Storage Temperature: Data not available
9.3 Inert Atmosphere: Data not available
9.4 Venting: Data not available

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

II

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	
Flammability (Red)	1
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 163.01
12.3 Boiling Point at 1 atm: 421°F = 216°C = 489°K
12.4 Freezing Point: 110°F = 45°C = 318°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.45 at 15°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.17 Heat of Fusion: Data not available
12.18 Limiting Value: Data not available
12.19 Reid Vapor Pressure: Data not available

NOTES

CHRIS, W. III

JUNE 1985

LEAD CHLORIDE

LCL

Common Synonyms	Solid White
Lead dichloride Plumbous chloride Lead (II) chloride	Sinks and mixes with water.

Avoid contact with solid and dust. Keep people away.
Wear goggles, self-contained breathing apparatus, rubber overclothing (including gloves).
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
POISONOUS METAL FUMES MAY BE PRODUCED IN FIRE.
Wear goggles, self-contained breathing apparatus, rubber overclothing (including gloves).

Exposure

CALL FOR MEDICAL AID.

DUST AND FUMES.
POISONOUS IF INHALED.
Move to fresh air.
Keep victim quiet and warm.

SOLID
If swallowed, may cause metallic taste, abdominal pain, vomiting and diarrhea.
Flush affected area with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk, have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS, do nothing except keep victim warm.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning - water contaminant.
Restrict access.
Should be removed.
Chemical and physical treatment.

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $PbCl_2$
3.3 SEO/UN Designation: Not listed
3.4 DOT ID No.: Data not available
3.5 CAS Registry No.: 7758-95-4

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid (crystal powder)
4.2 Color: White
4.3 Odor: Data not available

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Wear approved filter mask, rubber gloves, and safety glasses.
5.2 Symptoms Following Exposure: INHALATION: Joint and muscle pains, headache, dizziness and insomnia. Weakness, frequently of extensor muscles of hand and wrist (unilateral or bilateral). Heavy contamination - brain damage. Stupor progressing to coma - with or without convulsion, often death. Exaltation, confusion, and mania less common. Cerebrospinal pressure may be increased. INGESTION: Abdominal pain, diarrhea, constipation, loss of appetite, muscular weakness, headache, blue line on gums, metallic taste, nausea, and vomiting.
5.3 Treatment of Exposure: Call a physician. INHALATION: Remove from source of exposure. Keep victim quite and warm. EYES: Flush with plenty of water. SKIN: Wash with soap and water. INGESTION: Induce vomiting and follow with gastric lavage. Administer saline cathartic and an enema. Give antispasmodic (pentone glucoronate, atropine, papaverine) for relief of colic. If pain is severe morphine sulfate may be considered.
5.4 Threshold Limit Value: 0.15 mg/m³ as lead.
5.5 Short Term Inhalation Limits: 0.45 mg/m³ as lead.
5.6 Toxicity by Ingestion: Guinea pig minimum lethal dose 1000 to 2000 mg/kg.
5.7 Late Toxicity: In man 6 mg/m³/day inhaled long term produces histological and pathological effects. 1.2 mg/day ingested long term produces CNS disorders. Teratogenic effects.
5.8 Vapor (Gas) Irritant Characteristics: Data not available
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: Not pertinent
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic metal fumes
6.6 Behavior in Fire: Can emit toxic metal fumes
6.7 Ignition Temperature: Not pertinent
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: Data not available
7.3 Stability During Transport: Data not available
7.4 Neutralizing Agents for Acids and Caustics: Data not available
7.5 Polymerization: Data not available
7.6 Inhibitor of Polymerization: Data not available
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
8.58 ppm/96-hour/TL_/Fathead minnow/salt water
462 ppm/96-hour/TL_/Fathead minnow/hard water
23.8 ppm/96-hour/TL_/Bluegill/salt water
442 ppm/96-hour/TL_/Bluegill/hard water
31.5 ppm/96-hour/TL_/Goldfish/salt water
20.6 ppm/96-hour/TL_/Guppy/salt water
8.3 Waterfowl Toxicity: Data not available

(Continued)

9. SHIPPING INFORMATION

9.1 Grades of Purity: Data not available
9.2 Storage Temperature: Data not available
9.3 Inert Atmosphere: Data not available
9.4 Venting: Data not available

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

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11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: CR&S
11.2 IMO Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 278.12
12.3 Boiling Point at 1 atm: 1742°F = 950°C = 1223.2°K
12.4 Freezing Point: 933.8°F = 501°C = 774.8°K
12.5 Critical Temperature: Data not available
12.6 Critical Pressure: Data not available
12.7 Specific Gravity: 5.85 at room temperature
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: 9.59 (calculated)
12.11 Ratio of Specific Heats of Vapor (Gas): Data not available
12.12 Latent Heat of Vaporization: 191.5 Btu/lb = 106.4 cal/g = 4.46 X 10^5 J/kg
12.13 Heat of Combustion: Data not available
12.14 Heat of Decomposition: Data not available
12.15 Heat of Solution: Endothermic 40.1 Btu/lb = 22.3 cal/g = 0.93 X 10^5 J/kg
12.16 Heat of Polymerization: Not pertinent
12.26 Heat of Fusion: 20.3 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

8. WATER POLLUTION (Continued)

8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: Both fish and animal life can concentrate lead.

CHRIS, VOL. III

MERCURY

MCR

Common Synonyms	Liquid	Silver	Odorless
Quicksilver	Sinks in water.		

AVOID CONTACT WITH LIQUID. Keep people away.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	Not flammable.
Exposure	CALL FOR MEDICAL AID. LIQUID Effects of exposure may be delayed.
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: Hg
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: 2809
3.5 CAS Registry No.: 7439-97-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Silvery
4.3 Odor: None

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Avoid contact of liquid with skin. For vapor use chemical cartridge (Hopcalite) respirator.
5.2 Symptoms Following Exposure: No immediate symptoms. As poisoning becomes established, slight muscular tremor, loss of appetite, nausea, and diarrhea are observed. Peptic, kidney, and cardiovascular disturbances may occur.
5.3 Treatment of Exposure: Consult a doctor.
5.4 Threshold Limit Value: 0.05 mg/m³
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: No immediate toxicity
5.7 Late Toxicity: Development of mercury poisoning
5.8 Vapor (Gas) Irritant Characteristics: None
5.9 Liquid or Solid Irritant Characteristics: None
5.10 Odor Threshold: Not pertinent
5.11 IDLH Value: 28 mg/m³

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not flammable
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
0.5-1 ppm/48 hr/crangius ardum/TL$_m$/fresh water
0.29 ppm/48 hr/marine fish/TL$_m$/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: Mercury concentrates in liver and kidneys of ducks and geese to levels above FDA limit of 0.5 ppm. Muscle tissue usually well below the limit.

9. SHIPPING INFORMATION

9.1 Grades of Purity: Pure
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-B
11.2 MAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 200.59
12.3 Boiling Point at 1 atm: 675°F = 357°C = 630°K
12.4 Freezing Point: −38.0°F = −38.9°C = 234.3°K
12.5 Critical Temperature: 2864°F = 1462°C = 1736°K
12.6 Critical Pressure: 23,300 psia = 1587 atm = 160.8 MN/m²
12.7 Specific Gravity: 13.56 at 20°C (liquid)
12.8 Liquid Surface Tension: 470 dynes/cm = 0.470 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 375 dynes/cm = 0.375 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.26 Heat of Fusion: 2.7 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

CHRIS, Vol. III

PENTACHLOROPHENOL

PCP

Common Synonyms	Solid beads or flakes White to light brown
Dowicide 7 Penta Santophen 20	Sinks in water.

Avoid contact with solid and dust. Keep people away.
Wear goggles and self-contained breathing apparatus.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.

Exposure

CALL FOR MEDICAL AID.

DUST
Irritating to eyes, nose and throat.
If inhaled, will cause coughing or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

SOLID
POISONOUS IF SWALLOWED.
Will burn skin and eyes.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-poison
Restrict access
Should be removed

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: C_6Cl_5OH
3.3 IMO/IMI Designation: 6.1/2020
3.4 DOT ID No.: 2020
3.5 CAS Registry No.: 87-86-5

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: Colorless to light brown
4.3 Odor: Very weak

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Respirator for dust; goggles; protective clothing.
5.2 Symptoms Following Exposure: Dust or vapor irritates skin and mucous membranes, causing coughing and sneezing. Ingestion causes loss of appetite, respiratory difficulties, anesthesia, sweating, coma. Overexposure can cause death.
5.3 Treatment of Exposure: Call a doctor! INGESTION: Induce vomiting at once. EYES: flush with water for 15-20 min. SKIN: wash well with soap and water.
5.4 Threshold Limit Value: 0.5 mg/m³
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg (rat)
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapor is moderately irritating such that personnel will not usually tolerate moderate or high vapor concentrations.
5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: 150 mg/m³

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Generates toxic and irritating vapors.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: 5 ppm/3 hr/trout/lethal/fresh water
8.2 Waterfowl Toxicity: 4000 ppm/LC_{50}/mallards
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: 86-100%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

8

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-E
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 266.35
12.3 Boiling Point at 1 atm: 590°F = 310°C = 583°K
12.4 Freezing Point: 370°F = 188°C = 461°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.98 at 15°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

CHART, VOL. III

JUNE 1985

POLYCHLORINATED BIPHENYL

PCB

Common Synonyms	City liquid to solid powder	Light yellow liquid, or white powder	Weak odor
PCB Chlorinated biphenyl Aroclor Halogenated waxes Polychlorobiphenyls	Sinks in water.		

Stop discharge if possible. Keep people away.
Avoid contact with liquid and solid.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with water, foam, dry chemical, or carbon dioxide.

Exposure

CALL FOR MEDICAL AID.

LIQUID OR SOLID
Remove to fresh air and rest.
If skin becomes irritated, wash with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-water contaminant
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $(C_{12}H_{10-x}Cl_x)$
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: 2315
3.5 CAS Registry No.: 1336-36-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid or solid
4.2 Color: Pale yellow (liquid); colorless (solid)
4.3 Odor: Practically odorless

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Gloves and protective garments.
5.2 Symptoms Following Exposure: Acne from skin contact.
5.3 Treatment of Exposure: SKIN: wash with soap and water.
5.4 Threshold Limit Value: 0.5 to 1.0 mg/m³
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 2; oral rat LD_{50} = 3000 mg/kg
5.7 Late Toxicity: Causes chromosomal abnormalities in rats, birth defects in birds
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause severe irritation of eyes and throat and cause eye and lung injury. They cannot be tolerated even at low concentrations.
5.9 Liquid or Solid Irritant Characteristics: Contact with skin may cause irritation.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: 5 to 10 mg/m³

6. FIRE HAZARDS

6.1 Flash Point: > 200°F
6.2 Flammable Limits in Air: Data not available
6.3 Fire Extinguishing Agents: Water, foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Irritating gases are generated in fires.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Data not available
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Data not available
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
0.278 ppm/96 hr/bluegill/TL$_m$/fresh water
0.005 ppm/336-1080 hr/pinfish/TL$_m$/salt water
8.2 Waterfowl Toxicity: LD_{50} 2000 ppm (mallard duck)
8.3 Biological Oxygen Demand (BOD): Very low
8.4 Food Chain Concentration Potential: High

9. SHIPPING INFORMATION

9.1 Grades of Purity: 11 grades (some liquid, some solids) which differ primarily in their chlorine content (20%-68% by weight)
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

II

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-E
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: Very high
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.3—1.8 at 30°C (liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.17 Heat of Fusion: Data not available
12.18 Limiting Value: Data not available
12.19 Reid Vapor Pressure: Data not available

NOTES

CHRIS, VOL III

PHOSGENE

PHG

Common Synonyms
Carbonyl chloride
Chloroformyl chloride

Liquefied compressed gas. Colorless gas, or light yellow liquid. Sweet or sharp odor

Liquid sinks in water. Poisonous vapor is produced. Boiling point is 47°F.

AVOID CONTACT WITH LIQUID AND VAPOR. Keep people away
Wear goggles and self-contained breathing apparatus.
Stop discharge if possible.
Evacuate area in case of large discharge.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
POISONOUS GASES ARE PRODUCED WHEN HEATED.
Wear goggles and self-contained breathing apparatus.
Cool exposed containers and protect men effecting shutoff with water.

Exposure

CALL FOR MEDICAL AID

VAPOR
POISONOUS IF INHALED.
Irritating to eyes, nose, and throat.
Effects may be delayed.
Move to fresh air.
If breathing has stopped, give artificial respiration.
Best NOT mouth-to-mouth).
If breathing is difficult, give oxygen.
Maintain absolute rest until medical aid arrives.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-poison
Restrict access
Evacuate area

2. LABEL

2.1 Category: Poison
2.2 Class: 6

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $COCl_2$
3.3 IMO/UN Designation: 2.3/1076
3.4 DOT ID No.: 1076
3.5 CAS Registry No.: 75-44-5

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Compressed gas
4.2 Color: Colorless
4.3 Odor: Sharp, pungent odor in higher concentrations; like new-mown grass in low concentrations.

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved U.S. Bureau of Mines respirator; protective clothing.
5.2 Symptoms Following Exposure: Irritates lungs, causing delayed pulmonary edema. Slight gassing produces dryness or burning sensation in the throat, rumbleness, pain in the chest, bronchitis, and shortness of breath.
5.3 Treatment of Exposure: INHALATION: remove victim from contaminated area; enforce absolute rest; call a doctor.
5.4 Threshold Limit Value: 0.1 ppm
5.5 Short Term Inhalation Limits: 1 ppm for 5 min.
5.6 Toxicity by Ingestion: Not pertinent
5.7 Late Toxicity: Severe delayed pulmonary edema.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause severe irritation of eyes and throat and can cause eye and lung injury. They cannot be tolerated even at low concentrations.
5.9 Liquid or Solid Irritant Characteristics: Severe irritant to all tissues.
5.10 Odor Threshold: 0.5 ppm
5.11 IDLH Value: 2 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Water to cool containers
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic gas is generated when heated.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Decomposes, but not vigorously.
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Can be absorbed in caustic soda solution. One ton of phosgene requires 2,480 lbs. of caustic soda dissolved in 1000 gal. of water.
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Water Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Commercial, 100%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Safety relief

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-C-I-J-O

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Poison, A
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	4
Flammability (Red)	0
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Gas
12.2 Molecular Weight: 98.92
12.3 Boiling Point at 1 atm: 46.8°F = 8.2°C = 281.4°K
12.4 Freezing Point: −198°F = −128°C = 147°K
12.5 Critical Temperature: 360°F = 182°C = 455°K
12.6 Critical Pressure: 823 psia = 56.0 atm = 5.67 MN/m²
12.7 Specific Gravity: 1.38 at 20°C (liquid)
12.8 Liquid Surface Tension: 22.8 dynes/cm = 0.0228 N/m at 0°C
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: 3.4
12.11 Ratio of Specific Heats of Vapor (Gas): 1.170
12.12 Latent Heat of Vaporization: 110 Btu/lb = 59 cal/g = 2.5 X 10⁴ J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.17 Heat of Fusion: Data not available
12.18 Limiting Value: Data not available
12.19 Reid Vapor Pressure: Data not available

NOTES

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VINYL CHLORIDE

VCM

Common Synonyms	Gas	Colorless	Sweet odor
Chloroethylene VCL Vinyl C Monomer VCM	Liquid floats and boils on water. Flammable, irritating vapor cloud is produced.		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "wash down" vapor.
Evacuate area in case of large discharge.
Avoid contact with liquid and vapor.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
POISONOUS GAS IS PRODUCED IN FIRE.
Flashback along vapor trail may occur.
May explode if ignited in confined area.
Water self-contained breathing apparatus.
Cool exposed containers and protect men attacking shutoff with water.
Stop flow of gas if possible.
Let fire burn.
Extinguish small fires with dry chemical.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose, and throat.
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will cause frostbite.
Flush affected areas with plenty of water.
DO NOT RUB AFFECTED AREAS.

Water Pollution

Not harmful to aquatic life.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-High flammability
Evacuate area

2. LABEL

2.1 Category: Flammable gas
2.2 Class: 2

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Vinyl halides
3.2 Formula: $CH_2=CHCl$
3.3 IMO/UN Designation: 2.0/1086
3.4 DOT ID No.: 1086
3.5 CAS Registry No.: 75-01-4

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquified compressed gas
4.2 Color: Colorless
4.3 Odor: Pleasant, sweet

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Rubber gloves and shoes; gas-tight goggles; organic vapor canister or self-contained breathing apparatus.
5.2 Symptoms Following Exposure: INHALATION: high concentrations cause dizziness, anesthesia, lung irritation. SKIN: may cause frostbite; phenol inhibitor may be absorbed through skin if large amounts of liquid evaporate.
5.3 Treatment of Exposure: INHALATION: remove patient to fresh air and keep him quiet and warm; call a doctor; give artificial respiration if breathing stops. EYES AND SKIN: flush with plenty of water for at least 15 min; for eyes, get medical attention; remove contaminated clothing.
5.4 Threshold Limit Value: 5 ppm
5.5 Short Term Inhalation Limits: 500 ppm for 5 min.
5.6 Toxicity by Ingestion: Not pertinent
5.7 Late Toxicity: Chronic exposure may cause liver damage.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of skin. May cause frostbite.
5.10 Odor Threshold: 260 ppm
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: —110°F C.C.
6.2 Flammable Limits in Air: 4%-22%
6.3 Fire Extinguishing Agents: For small fires use dry chemical or carbon dioxide. For large fires stop flow of gas. Cool exposed containers with water.
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Forms highly toxic combustion products such as hydrogen chloride, phosgene, and carbon monoxide.
6.6 Behavior in Fire: Container may explode in fire. Gas is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 882°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 4.3 mm/min.

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Polymerizes in presence of air, sunlight, or heat unless stabilized by inhibitors.
7.6 Inhibitor of Polymerization: Not normally used except when high temperatures are expected. Then 40-100 ppm of phenol used.
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 35

8. WATER POLLUTION

8.1 Aquatic Toxicity: None
8.2 Waterfowl Toxicity: None
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Commercial or technical 99 + %
9.2 Storage Temperature: Under pressure; ambient At atm. pressure; low
9.3 Inert Atmosphere: No requirement
9.4 Venting: Under pressure; safety relief At atm. pressure; pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-B-C-D-E-F-G-Z

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable gas
11.2 MAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	4
Health	
Vapor Irritant	2
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	0
Aquatic Toxicity	0
Aesthetic Effect	0
Reactivity	
Other Chemicals	2
Water	0
Self Reaction	2

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	4
Reactivity (Yellow)	1

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Gas
12.2 Molecular Weight: 62.50
12.3 Boiling Point at 1 atm: 7.5°F = 13.8°C = 259.4°K
12.4 Freezing Point: —344.8°F = —153.8°C = —119.4°K
12.5 Critical Temperature: 217.1°F = 158.4°C = 431.6°K
12.6 Critical Pressure: 775 psia = 52.7 atm = 5.34 MN/m²
12.7 Specific Gravity: 0.969 at —13°C (liquid)
12.8 Liquid Surface Tension: 16.0 dynes/cm = 0.0160 N/m at 25°C
12.9 Liquid Water Interfacial Tension (est.): 30 dynes/cm = 0.03 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 2.2
12.11 Ratio of Specific Heats of Vapor (Gas): 1.106
12.12 Latent Heat of Vaporization: 160 Btu/lb = 89 cal/g = 3.7 X 10⁴ J/kg
12.13 Heat of Combustion: —8139 Btu/lb = —4520 cal/g = —189.1 X 10⁴ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: —729 Btu/lb = —405 cal/g = 16.9 X 10⁴ J/kg
12.26 Heat of Fusion: 18.14 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 75 psia

6. FIRE HAZARDS (Continued)

6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: 8.480 (Est.)
6.12 Flame Temperature: Data not available

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JUNE 1985

o-XYLENE

XLO

Common Synonyms			
1,2-Dimethylbenzene Xylol	Watery liquid	Colorless	Sweet odor

Floats on water. Flammable, irritating vapor is produced.

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Floating to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: o-$C_6H_4(CH_3)_2$
3.3 IMO/UN Designation: 3.2/1307
3.4 DOT ID No.: 1307
3.5 CAS Registry No.: 95-47-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Benzene-like; characteristic aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur.
5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 300 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Kidney and liver damage.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.05 ppm
5.11 IDLH Value: 10,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 69°F C.C.; 75°F O.C.
6.2 Flammable Limits in Air: 1.1%-7.0%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 867°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 38

8. WATER POLLUTION

8.1 Aquatic Toxicity: > 100 mg/l/96 hr/D. magna/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 2.5% (theor.), 5 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research: 99.99%; Pure: 99.7%; Commercial: 95+%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No reaction
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.16
12.3 Boiling Point at 1 atm: 291.9°F = 144.4°C = 417.6°K
12.4 Freezing Point: −13.3°F = −25.2°C = 248.0°K
12.5 Critical Temperature: 674.8°F = 357.1°C = 630.3°K
12.6 Critical Pressure: 541.5 atm = 36.84 psia = 3.732 MN/m²
12.7 Specific Gravity: 0.880 at 20°C (liquid)
12.8 Liquid Surface Tension: 30.53 dynes/cm = 0.03053 N/m at 15.5°C
12.9 Liquid Water Interfacial Tension: 36.08 dynes/cm = 0.03606 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.088
12.12 Latent Heat of Vaporization: 149 Btu/lb = 82.9 cal/g = 3.47 X 10^5 J/kg
12.13 Heat of Combustion: −17,580 Btu/lb = −9754.7 cal/g = −408.41 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.17 Heat of Fusion: 30.64 cal/g
12.18 Limiting Value: Data not available
12.17 Reid Vapor Pressure: 0.39 psia

NOTES

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JUNE 1985

ecology and environment, inc.

ON-SITE SAFETY LOG

	Background Reading in Breathing Zone	Calibrated At	On-Site Reading in Breathing Zone
A. On-Site Monitoring			
1. HNU/OVA and calibration gas			
2. Rad-mini			
3. Monitox			
4. O_2/Explosimeter and calibration gas			
5. Dust monitor			

B. Protective Clothing Worn: _____

C. Site Name: Dead Creek Project Project Number: _____

Date: _____

Weather Conditions: _____

Name of Attendees at Site: _____

D. Comments on Monitoring or Protective Clothing: _____

	Name	Signature
Team Leader:		
Site Safety Officer:		

HISTORY

The study area for the Dead Creek Project (DCP) consists of 18 sites in the towns of Sauget and Cahokia in St. Clair County, Illinois (see attached map). The Illinois EPA became aware of the problems in this area in 1980 when periodic smoldering of materials in a ditch (Dead Creek) was observed. Following an initial inspection, the agency received information that a local resident's dog had come in contact with wastes in the ditch and died of apparent chemical burns.

Historically, during World War II, the study area was heavily developed by industry to support the war effort. Due to this development and the geologic conditions in the area, open pit mining occurred in many areas to supply sand and gravel resources. Following the war, excess product was landfilled and covered in the numerous excavations. Wastes reported to have been buried in these excavations include phosgene gas and munitions in addition to organic and inorganic industrial wastes. The excavated areas were identified by the Illinois EPA from a series of past aerial photographs, and by a thermal infrared survey of the area.

The filling of past excavations was followed by utilization of Dead Creek as receiving water for effluent and surface drainage of various industries. The Illinois EPA performed a preliminary study of the area in 1980, finding excessive levels of organic and inorganic contaminants in and around the creek. Contaminants detected included: PCBs, aliphatic hydrocarbons, dichlorobenzene, lead, cadmium, and arsenic. During the Illinois EPA study, drillers were overcome by organic vapors while installing a monitoring well east of the creek

and adjacent to a former seepage lagoon. Sampling of this well and the lagoon indicated high levels of the aforementioned contaminants.

Following World War II, chemical companies in the area returned to normal processes, including the manufacturing of defoliants, pesticides, and herbicides. From the mid-1950s to the early 1970s, the byproducts and wastes from these manufacturing processes were landfilled in the Site R and possibly Site Q areas (see map). Drilling and sampling by E & E in 1983 at Site Q indicated the presence of 63 of the 117 priority pollutants designated by the USEPA, including quantifiable levels of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Dioxin was also detected in soil samples at Site O. Site P is an Illinois EPA-permitted landfill known to have accepted hazardous waste residues in violation of their permit.

Site G (Inactive Site). Drums and pits observed on the surface. Appear to contain oily wastes (drums - unknown black cinder-like solid).

Contaminants detected in groundwater: PCB (1.0 ppb), chlorophenol (1,200 ppb), chlorobenzene (19 ppb), dichlorobenzene (25 ppb), dichlorophenol (890 ppb), phosphorus (9.4 ppm), and lead (.31 ppm); surface soils: arsenic (16 ppm), lead (2,000 ppm), and PCB (350 ppm).

Depth profiles from creek shows PCB ranging from 9,200 ppm at the surface to 54 ppm at 6 feet.

November 1985 - no readings above background with site entry equipment. Physical hazards - three or four pits with exposed drums, numerous areas mounded with buried drums, poison ivy.

Site H (Inactive Site). Former sand and gravel pit which was filled with construction debris and unknown wastes. Presently covered and well vegetated. Physical hazards - trip and fall. One downgradient well - PCB - 1.0 ppb. No surface soil sampling done. No pits, ponds, etc. on-site.

Site T (Active Plant Site). Cerro copper property. Holding lagoon on site was formerly head water per Dead Creek. Culvert under New Queeny Avenue was blocked sometime after 1950. G112 only groundwater monitoring point for the site - analysis indicates chlorobenzene and dichlorobenzene, along with metals. Soil samples from areas

adjacent to the holding pond indicate PCB (0.3 ppm) and aliphatic hydrocarbons (26 ppm) along with dichlorobenzene (1.7 ppm). Also arsenic (95.8 ppm). Surface water samples from holding pond show: nickel (4.2 ppm), arsenic (0.58 ppm), zinc (30 ppm), PCB (28 ppm), aliphatic hydrocarbons (23,000 ppm).

Plant site: Level D with hardhat, safety glasses, necessary - presently no water in former holding pond. Sand and gravel pit identified from historical aerial photos now filled and covered (parking area for trailers).

Site J (Active Plant Site). Sterling Steel Castings. No previous study done. Aerial photos indicate possible disposal. From visual observation and conversation with plant operator, material disposed of consists of casting sand and slag. (Needs groundwater monitoring). Two pits exist on site approximately 30' deep. Two to three drums are evident along the sides. Site also has an inactive incinerator. Possible contaminants include epoxy resins, heavy metals.

Site K (Residential Commercial). No information exists for this site. Historical aerial photos indicate possible dumping. Presently, trailer homes and a small trucking company occupy the property.

Site L (Active Equipment Repair Site). Historical photos indicate a small surface impoundment once existed on the site (Wagganer Trucking). Wagganer was an industrial waste hauler - trucks cleaned on site discharge first into creek, then into impoundment. Wagganer specialized in hauling hazardous materials. Downgradient groundwater analysis: chlorophenol (19 ppb), and cyclohexane (120 ppb). Soils: PCB (5,200 ppm), trichlorobenzne (78 ppm), and hydrocarbons: (21,000 ppm). Presently, site is covered with cinders with no evidence of where the pit was situated.

Site M (Inactive Pit). Hall Const. Pit - site consists of an open pit used for dumping of unknown wastes. Surface soils: PCB, arsenic, and mercury. Surface water: PCB, phosphorus (low levels). Presently, pit is inside fence which surrounds Dead Creek between New Queeeny Avenue and Judith Lane. Steep sloping sides, water present in pit.

Site N (Inactive Construction Site). No historical information is available for this site. Historical photos indicate possible disposal. Presently site is occupied by an inactive construction company. No previous studies performed.

Site O (Active STP). American Bottany wastewater treatment plant. Historically, three lagoons were used for sludge dewatering. Lagoon area is now covered and vegetated. Preliminary sampling indicates PCB, miscellaneous hydrocarbons. No field work proposed for initial phase of study.

Site P (Inactive Permitted Landfill). An IEPA permitted landfill known to have accepted hazardous residues in violation of their permit. Types and quantities of wastes recorded are unknown. No sampling has been done at the site. Presently municipal and construction debris (asbestos) are evident along with cinders, no drums evident. Site is still permitted, though no longer active.

Site Q (Inactive Landfill - Active Transport Facility). Consists of a former unpermitted landfill suspected of receiving hazardous wastes. Located adjacent to the Sauget Toxic Dump. E & E sampling (soil borings) indicated the presence of 63 priority pollutants, including 2,3,7,8-TCDD. No groundwater monitoring has been done at the site - power lines traverse the entire area. Area covered entirely by black cinders. Some refuse (appliances, debris, etc.) randomly dumped in rear portion of property.

Site R (Inactive Landfill). Sauget Toxic Dump - Former chemical dump owned and operated by Monsanto. Contaminants detected in leachate include solvents and 2,3,7,8-TCDD (TAT sampling - 1981). Presently, site is well covered and vegetated. Monsanto tank farm for feedstocks located in the northern portion of the site. No drilling expected. Hard hat and safety glasses required by Monsanto.

Dog #86-140

L1630200005 St. Clair Co. Sauget Sites Superfund Technical Reports

Illinois Environmental Protection Agency · 2200 Churchill Road, Springfield, IL 62706

MEMORANDUM

DATE: July 25, 1986

TO: Jeff Larson

FROM: Ron Turpin

SUBJECT: L1630200005 - St. Clair County
Sauget/Sauget Sites
Review of Revised QAPP

The Division of Laboratories Quality Assurance Section has reviewed the revised Quality Assurance Project Plan (QAPP) submitted by Ecology and Environment, Inc. (E&E) in support of the Remedial Investigation (RI) to be performed at the above referenced SRAPL site. We find that one of my previous comments has not been satisfactorily addressed. The document entitled "E & E's Laboratory and Field Personnel Chain-of Custody and Quality Assurance/Quality Control Procedures Manual, April 1986", referred to in Sections five, six and eight of the QAPP must be submitted to the Agency for review. The copy we now have is dated December, 1985. In order to approve the QAPP, we must evaluate the sections of the document referred to.

Since my other comments have been adequately addressed in the revision, I will approve the QAPP when I have reviewed the applicable sections of "E & E's Laboratory and Field Personnel Chain-of Custody and Quality Assurance/Quality Control Procedures Manual, April 1986", if those sections are acceptable.

cc: Karl Reed
Bina Fleck

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

MEMORANDUM

Ted

DATE: July 23, 1986

TO: Jeff Larson

FROM: Jeffrey K. Niemann JKN

SUBJECT: Site Safety Plan
Sauget Sites Project
Sauget/Cahokia

I would recommend only a few changes to the existing site safety plan for the Sauget Sites Project. A site safety plan should be a short concise document which supplies immediate information to personnel for routine work and possible emergency situations. The site safety plan should be separate from the scope of work and the information titled "History" (C-26) and "Dead Creek" (C-28) should be deleted or supplied as an appendix to the plan. Other comments are as follows:

1) The task-specific levels of protection noted on C-31 should be part of the plan and be attached following page C-3.

2) Decontamination of airlines for supplied air respirators should be noted on page C-5.

3) Though the scope of work would not indicate a probable spill of hazardous materials, the telephone numbers for ESDA and IEPA ERU should be listed on page C-7.

4) A hand drawn map of the emergency routes to the indicated hospitals should be attached to page C-8. A photocopy of road maps is not acceptable since road and street information is usually to small to read.

5) A stretcher should be included in the list of materials on page C-10. In the event of an accident or heat stress the worker can be moved for decontamination and to a shaded area while the ambulance is in route.

6) The "Hazard Evaluation of Chemicals" form supplied on page C-11 is well organized and written. The information on pages C-16 to C-24 is not readable. A better reproduction or use of the format on page C-11 should be utilized.

7) For emergency situations on air horn or radio should be listed on page C-10. With the use of Levels C and B protection on this project, a greater risk exists for heat exhaustion or stroke and emergency communication becomes necessary.

If you should have any further questions, contact me at 785-0830.

JKN/psf

Log 86-12

163020000 5 St Clair
Sanget Sites
Superfund/Task

ecology and environment, inc.

111 WEST JACKSON BLVD., CHICAGO, ILLINOIS 60604, TEL. 312-663-9415

International Specialists in the Environment

May 16, 1986

MAY 19 1986

Mr. Jeff Larson
Division of Land Pollution Control
Illinois EPA
2200 Churchill Road
Springfield, Illinois 62706

Dear Jeff:

Attached please find four copies of the Dead Creek Project Work Plan which include revisions made in response to IEPA's comments on the Draft Work Plan. We look forward to your approval of the plan and acquisition of site access agreements so that field work on the project can resume.

Very truly yours,

Michael L. Miller

Michael L. Miller, P.E.

MLM:mh

cc. Dir File
Ron T
Chem Safety - Community Relation -
Share for review.

Illinois Environmental Protection Agency · 2200 Churchill Road, Springfield, IL 62706

MEMORANDUM

RECEIVED

DATE: March 20, 1986

TO: Jeff Larson

FROM: Ron Turpin

SUBJECT: Draft Work Plan Submitted by Ecology and Environment
L1630200005 -- St. Clair County
Sauget/Sauget Sites

The Division of Laboratories Quality Assurance Section has reviewed the Sampling Plan and Quality Assurance Project Plan (QAPP) sections of the Draft Work Plan submitted for the above referenced site. The QAPP was reviewed for conformance to USEPA guidance and contractual commitments to the IEPA. The Sampling Plan was reviewed only with respect to laboratory related Quality Assurance/Quality Control (QA/QC) issues. Our comments follow:

The Sampling Plan (Appendix B) does not specify whether the types of bottles listed in Table 4-1 are for soil/solid matrix, water matrix or for both (except for metals analysis, for which bottle types and preservation is specified for both soils and water). We recommend that the contractor modify Table 4-1 to specify the sample bottles to be used for all the matrices to be sampled during the project.

The Sampling Plan does not give specifications or procedures for sample bottle preparation or pretreatment. The contractor must include, in the Sampling Plan, procedures which will be used to prepare sample bottles. These procedures may be included by reference to existing laboratory standard operating procedures (SOPs) if the SOPs are submitted for review.

Section 3 of the QAPP, "Project Organization and Responsibility," must describe the IEPA's responsibilities for supervision and approval of QA/QC activities and documents. IEPA is responsible for initial Performance and System Audits (conducted in July and August of 1985), a scheduled Systems Audit during sample analysis for the project, auditing of QA/QC data validation procedures and final review and evaluation of analytical results and supporting QC data.

Section 4, "QA Objectives for Measurement Data," gives general definitions of the data quality measurements; accuracy, precision, completeness, representativeness, and comparability. The contractor must give more specific objectives for the following data quality measurements:

Paragraph 4.1, Accuracy; must include specific objectives for the accuracy of each analysis/matrix included in the project. Objectives must be minimum acceptable criteria for determining if the analysis

or method meets the requirements of the project. The contractor states that the obtained values for calibration and spiking solutions will be compared to true values using accepted statistical techniques. The accepted statistical technique must be specified along with the criteria to be used to document that the accuracy measured is acceptable. Reference may be made to other parts of the QAPP or to other documents where applicable.

Paragraph 4.2, Precision; states that EPA has estabished acceptable RPDs for many of the parameters. The contractor must specify what these criteria are or where they can be found. If there are parameters for which the EPA has not established RPD criteria, then the contractor must establish criteria based on the level of precision needed by the data users.

Paragraph 4.3, Completeness; must state specific objectives for completeness and specify against what criteria completeness will be measured to assure that data completeness for the project has met the criteria.

Section 5, "Sampling Procedures," must include the types of sample bottles, lids and preservative to be used for each analysis/matrix. Sample bottle preparation, pretreatment and QC must be included for each type of sample bottle. Reference may be made to the Sampling Plan or to the contractor's SOPs if they are submitted for review.

Section 6, "Sample Custody," refers to "E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, August 1985". The document submitted to the IEPA with the proposal is dated December, 1984. The contractor must submit the current document in order for us to properly review the chain-of-custody procedures.

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Section 9, "Data Reduction, Validation and Reporting," describes acceptable data reduction and reporting. Data validation procedures must include evaluation of the precision, accuracy, completeness and representativeness of the final data. The section, as written, describes laboratory data validation up to the point where the individual results are reported to the client. For this project, the contractor is the data

user (as the writer of the Remedial Investigation [RI] Report) and must incorporate procedures to validate that the data base as a whole and the individual results are suitable to support the RI Report. These data validation procedures are to be specified in this section of the QAPP.

Section 11, "Performance and System Audits," states that the Project Manager and QA Officer will create a schedule and institute a program for regular system and performance audits. The only mechanism for approving such a program and schedule is by inclusion in the approved QAPP; therefore, the performance and systems audit program must be included for review and approval in this QAPP.

RT:jab/636F/56-58

cc: Karl Reed
Bina Shah

Illinois Environmental Protection Agency · 2200 Churchill Road, Springfield, IL 62706

MEMORANDUM

DATE: March 18, 1986

TO: Jeff Larson

FROM: Ron Turpin

SUBJECT: Draft Work Plan Submitted by Ecology and Environment
L1630200005 - St. Clair County
Sauget/Sauget Sites

The Division of Laboratories Quality Assurance Section has reviewed the Sampling Plan and Quality Assurance Project Plan (QAPP) sections of the Draft Work Plan submitted for the above referenced site. The QAPP was reviewed for conformance to USEPA guidance and contractual commitments to the IEPA. The Sampling Plan was reviewed only with respect to laboratory related Quality Assurance/Quality Control (QA/QC) issues. Our comments follow:

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RT:rt/e&ewpsau

cc: Karl Reed
Bina Shah

Changes in
allowable levels
as approved by
IEPA.

QSPB Correspondence

Illinois Environmental Protection Agency · 2200 Churchill Road, Springfield, IL 62706

MEMORANDUM

DATE: July 25, 1986

TO: Jeff Larson

FROM: Ron Turpin

SUBJECT: L1630200005 - St. Clair County
Sauget/Sauget Sites
Review of Revised QAPP

The Division of Laboratories Quality Assurance Section has reviewed the revised Quality Assurance Project Plan (QAPP) submitted by Ecology and Environment, Inc. (E&E) in support of the Remedial Investigation (RI) to be performed at the above referenced SRAPL site. We find that one of my previous comments has not been satisfactorily addressed. The document entitled "E & E's Laboratory and Field Personnel Chain-of Custody and Quality Assurance/Quality Control Procedures Manual, April 1986", referred to in Sections five, six and eight of the QAPP must be submitted to the Agency for review. The copy we now have is dated December, 1985. In order to approve the QAPP, we must evaluate the sections of the document referred to.

Since my other comments have been adequately addressed in the revision, I will approve the QAPP when I have reviewed the applicable sections of "E & E's Laboratory and Field Personnel Chain-of Custody and Quality Assurance/Quality Control Procedures Manual, April 1986", if those sections are acceptable.

cc: Karl Reed
Bina Fleck

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

MEMORANDUM

Tech.

DATE: July 23, 1986

TO: Jeff Larson

FROM: Jeffrey K. Niemann JKN

SUBJECT: Site Safety Plan
Sauget Sites Project
Sauget/Cahokia

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If you should have any further questions, contact me at 785-0830.

JKN/psf

Sanget Sites
Superfund/Trash

ecology and environment, inc.

111 WEST JACKSON BLVD., CHICAGO, ILLINOIS 60604, TEL. 312-663-9415

International Specialists in the Environment

May 16, 1986

MAY 19 1986

Mr. Jeff Larson
Division of Land Pollution Control
Illinois EPA
2200 Churchill Road
Springfield, Illinois 62706

Dear Jeff:

Attached please find four copies of the Dead Creek Project Work Plan which include revisions made in response to IEPA's comments on the Draft Work Plan. We look forward to your approval of the plan and acquisition of site access agreements so that field work on the project can resume.

Very truly yours,

Michael L. Miller, P.E.

MLM:mh

cc. Dist File
Ron T
Chem Safety - Community Relation -
Share for review.

Illinois Environmental Protection Agency · 2200 Churchill Road, Springfield, IL 62706

MEMORANDUM

RECEIVED
MAR 2 6 1986
IEPA-DLPC

DATE: March 20, 1986

TO: Jeff Larson

FROM: Ron Turpin

SUBJECT: Draft Work Plan Submitted by Ecology and Environment
L1630200005 -- St. Clair County
Sauget/Sauget Sites

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RT:jab/636F/56-58

cc: Karl Reed
Bina Shah

Illinois Environmental Protection Agency · 2200 Churchill Road, Springfield, IL 62706

MEMORANDUM

DATE: March 18, 1986

TO: Jeff Larson

FROM: Ron Turpin

SUBJECT: Draft Work Plan Submitted by Ecology and Environment
L1630200005 - St. Clair County
Sauget/Sauget Sites

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RT:rt/e&ewpsau

cc: Karl Reed
Bina Shah